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Where Heat-Treatment Increased the Life of Machines

By Fred H. Colvin
Editor, *American Machinist*

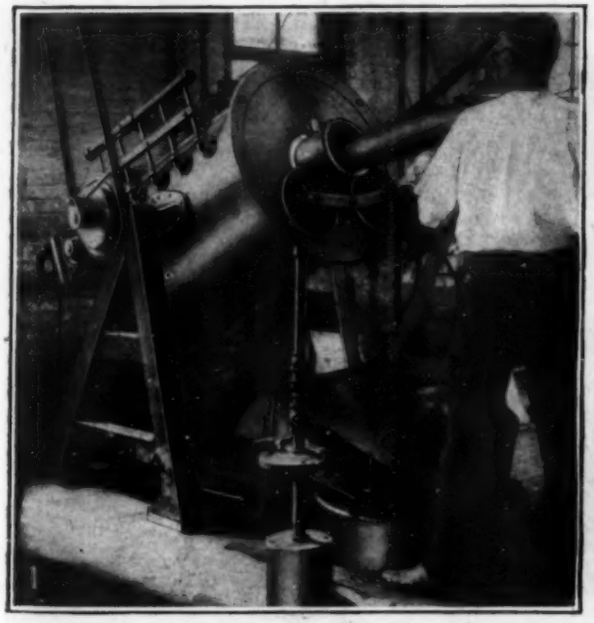
Depth of case tested at intervals—Temperature kept as low as possible—Reasons for sandblasting—Reheating to refine the core—Local carburization

ONE of the tasks the engineers of the Monroe Calculating Machine Co., Orange, N. J., have always set for themselves, is that of building a long life into their machines. This had been satisfactorily accomplished in the hand-operated machines, but the advent of motor-driven machines gave them new problems to solve. The increase in both the number of operations per day, and the shock imposed on the bearings, necessitated even greater care than formerly in the selection and heat-treatment of material for bearing surfaces.

As a result of the experimental work done and the equipment installed, the desired wearing qualities of the various members have been secured. But such results have been accomplished only by the utmost care and by constant vigilance in the heat-treating itself and in the inspection of parts before assembly. This article will not attempt to deal with details of heating temperatures or baths, since of necessity they vary with the material, its shape and the results required of each piece. It will, instead, give the methods that have proved successful and the equipment that has made the results possible.

Nearly all of the material is low-carbon steel, of S.A.E. specifications. The first heat-treating operation is to carburize the parts, the work being done in the American, rotary, gas-fired furnace shown in Figs. 1 and 2. Great care is taken in the selection of the carburizing material and in securing and maintaining the correct heat.

A pyrometer is placed in the back of the revolving muffle to check the actual temperature in the muffle itself. At the same time the heat is controlled by a regulator that depends on the heat in the chamber surrounding the muffle, so that the heat can be regulated very closely. Instead of setting a definite time for the carburizing of each lot of pieces, each charge is



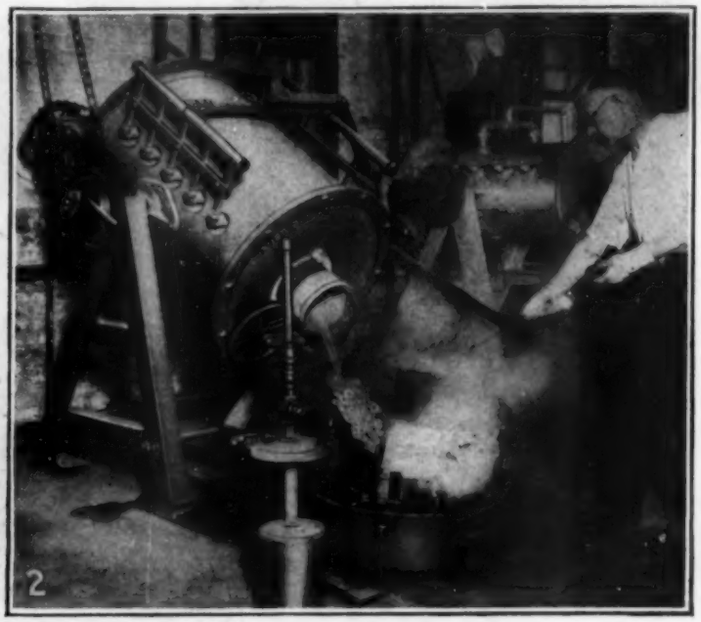


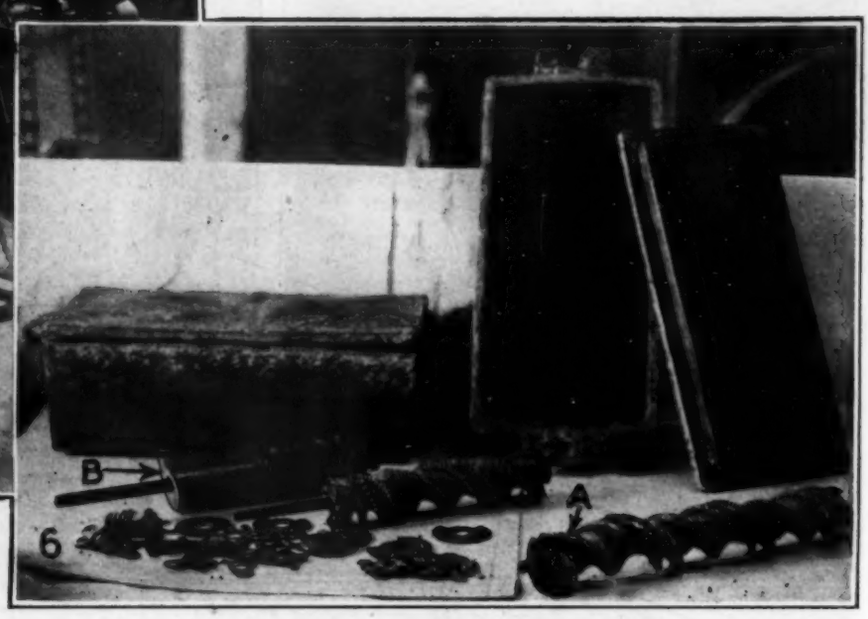
Fig. 1—Loading the carburizing furnace. Fig. 2—Dumping parts into oil bath

Fig. 3—Testing for hardness and depth of case

Fig. 4—The reheating furnace

Fig. 5—Special hardening machine

Fig. 6—Work carburized in boxes



checked as to its condition after it has been in the furnace a given time. The heat-treater in charge knows the approximate time necessary for carburizing the various pieces, and before the heat is completed he opens the furnace and takes out one or more pieces, breaking them to test the depth of the case. The hardness of the case is tested on a Rockwell machine and its depth is measured by optical means. The methods of making both tests are shown in Fig. 3. The heat is continued until a test piece shows the desired depth of case, and the charge is then dumped into the oil tank in front of the furnace. An inclined screen between the furnace and the quenching tank allows most of the carburizing material to fall through, keeping it from getting into the oil. The final test piece is tagged and kept for reference.

It has been found best to carburize work at as low a temperature as possible, even though it is realized that time can be shortened by using higher heats. While no exact temperatures can be given, since they depend upon conditions, the range for carburizing is between 1,450 and 1,550 deg. F. After coming from the oil bath the work is dried in sawdust in a tumbling barrel and then it is sandblasted in a tilted, revolving barrel. After sandblasting, the sand supply is shut off and the sand is blown from the work by the air jet alone. The work is sandblasted for two reasons: First, for appearance, and second, because the pieces feed through the "slab" or traveling-table furnace, shown in Fig. 4, much better after they have been freed from scale.

The usual temperature of this furnace varies from 1,400 to 1,450 deg. F. for the first reheating, which refines the grain of the core. The speed of the work through the furnace is timed to suit the piece and the results desired. In the discharge end of the furnace are two funnels, so arranged that the outer one projects into a revolving screen in the oil tank, and delivers the work inside the screen below the surface of the oil, so that no air strikes the work before the quenching. Some pieces that are to be subjected to severe wear or stresses, receive a second heat-treatment at a lower temperature, to refine the case, and in a few instances they are drawn and quenched afterward.

Use of Filtered Oil

It has been found that the quenching oil can be used for long periods by careful filtering. While it is well known that filtering does not restore the original qualities of the oil, and that it is not advisable to keep it at high temperature continuously, the conditions here make it both possible and advisable to filter the oil for further use, adding some new oil to the old. The oil in this plant gets never gets very hot, owing both to the use of cooling coils and to the fact that the quenching is not done continuously.

A few parts used in the calculating machine require local hardening at contact points. So, after carburizing, the pieces are placed on small Nichrome tables that form the conveyor shown in Fig. 5, and are passed over gas jets. The speed of the conveyor is so timed and the gas jets are so regulated as to secure the proper heat before the table reaches the point where the pieces are dropped into the quenching tank beneath.

Although this operation is seemingly automatic, in reality the mechanism is but an aid to the operator. The pieces are loaded on the conveyor by a helper and the hardener watches the heat of the parts before dumping. For watching the heat, a piece of dark-blue glass set in a frame is used as an eye shield, and it has been found that when the pieces being heated look dull red through the glass, they are at the correct temperature for quenching. In addition, the heat is periodically tested with a Shaw optical pyrometer. Pieces that do not show the proper heat are removed and reheated.

A few pieces only are treated by the cyanide process. But there are several that, for different reasons, are carburized in Nichrome boxes as in Fig. 6. In some cases it is necessary to prevent warping or distortion of a part, in order to have it fit in place between other parts without binding. To secure this freedom of fit,

Fig. 7—Trial inspection before assembly

the tolerance as to flatness must be kept within a very few thousandths of an inch. Such pieces are shown at *A*, Fig. 6. It has been found that by clamping pieces firmly together as at *A*, they can be carburized on the edges, and that distortion can be kept within the desired tolerance. The twist of the parts at *A* is due to a small projecting lip at the outer corner of each piece.

In a similar manner, the ratchets at *B* are clamped together for carburizing. In this case the reason is, however, somewhat different. It is necessary to drill a hole in the web or center of the ratchet after the teeth have been carburized, so that the center must be kept soft.

Not satisfied, however, with every precaution that can be taken in the heat-treating department, a 100 per cent inspection for hardness is made before the pieces go to the assembly department. A group of six Rockwell machines is used for this purpose, as in Fig. 7. In these machines steel balls are used. To insure uniformity and to get the best results possible, a new ball is put into each machine twice a day. The results of these methods and of the great care taken are highly satisfactory.

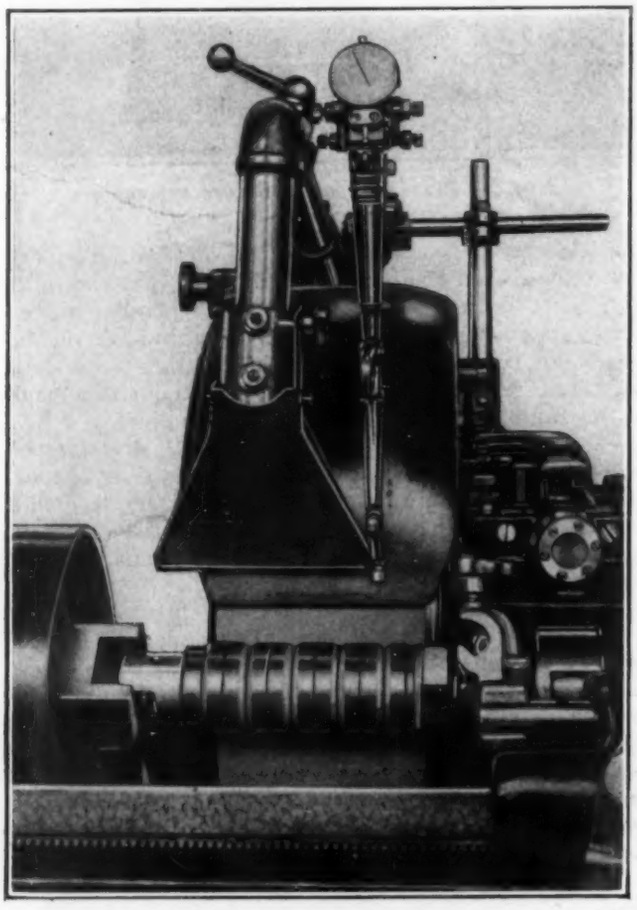
The great improvements in aviation engines is indicated by the lengthened flying life between overhauls. Where 50 hr. of flying was formerly the limit, the newer engines give in the neighborhood of 300 hr. between major overhauls. An example of this is given in the recent naval report of a Wright whirlwind engine with over 300 hr. of flying to its credit, without a skip in the air and but one adjustment for each valve. When we consider that the average plane flies at approximately 100 miles an hour and with a fairly wide open throttle, the life compares very favorably with that of the best automobile engines.

Cylindrical Grinding Without Traverse

By James Denton

THE job here shown is the grinding to diameter of the outer races, or cups, of roller bearings. Two special mandrels to hold nine cups each are provided. The distance from the headstock end of the mandrel to the face of the permanent shoulder is made greater in one mandrel than in the other, for a reason that will presently appear. The body of the mandrel is materially smaller than the through hole in the cups, and the cups are held on conical bushings that present a solid bearing surface during the grinding operation.

It is essential that the outer circumference of the cups shall finish concentric with the inner, or bearing surface, and so to center them on the mandrel there is placed between each facing pair of cups a bushing of a double cone shape having the largest diameter midway of its length. These bushings are bored to a fairly close fit on the arbor, and their coned faces match the



Wide-wheel grinding on roller-bearing cups

opposed conical surfaces of the respective cups—which have previously been ground—and so locate the cups concentrically on the mandrel.

The length of each double-cone bushing is slightly less than the space occupied on the mandrel by one pair of cups, so that when the retaining nut is tightened the string of cups is held by end pressure, each cup being firmly seated on its respective bushing.

The width of the grinding wheel is greater than the combined length of the string of cups it is to grind, and the grinding is accomplished by feeding the wheel straight toward the work without table traverse. The reason for the different location of the permanent shoulders, before mentioned, is so that the portion of the wheel face unused on one string of cups—the part that falls opposite to the spaces left by the adjacent beveled corners—will be a part of the active face of the wheel when grinding the cups on the other mandrel.

This precautionary measure forestalls a tendency for the wheel face to wear unevenly and thus renders less frequent the necessity for redressing. The machine is also equipped with an attachment that imparts a slight reciprocating movement to the wheel spindle, which is largely instrumental in preserving the accuracy of the wheel face.

The wheel used on this work is 20x6¾x12-in. Alundum of 1960 grit, grade J, vitrified bond. It runs at a peripheral speed of approximately 6,000 ft. per min., with 85 r.p.m. of the work. The work to be ground is 1.939 in. $^{+0.000.}_{-0.001.}$ in diameter.

The machine is a 10x18-in., type BA, Norton cylindrical grinding machine equipped with a continuous, power cross-feed attachment. It is provided with a Pratt grinding gage, a device with three anvils at the end of a jointed arm that may be swung down to span the work. One of the anvils is linked to a dial indicator so that the amount of stock remaining at any stage of the work to be removed may be read directly from the dial.

The stock to be removed from these pieces varied from 0.015 to 0.035 in. on the diameter. The wide variation is due largely to the runout, caused by the method of setting for the internal grinding operation, wherein it is necessary to set the pieces concentric with the bearing surfaces as they come from the hardening operation. The rate of production on the job here shown is 42 loadings, or 378 cups, per hour.

Straightening Cold-Rolled Plates—Discussion

By Alan L. Jervey

I noticed an article under the title given above, on page 870, Vol. 64, of the *American Machinist*, in which H. R. Fowler tells of his difficulties in straightening plates and asks for more light on the subject.

A bent plate can be straightened by holding it in a vise or in a pair of clamps and bending it back a little beyond its original lines. This method is better than hammering, since hammering, unless one has had experience, may cause the plate to buckle.

A buckled plate is one having dished or saucer-like depressions, or bumps (depending upon which side of the plate is looked at) that may have been caused by unequal heating, unequal cooling, or by hammering.

If it is desired to make a metal saucer, cut out a disk and hammer it over a convex plate, starting at the center and working out lightly toward, but not quite to, the edge, giving the heaviest blows at the center.

If a metal saucer is to be flattened, lay it on a flat plate and hammer the outer edge, working gradually toward the center. The heaviest blows should be at the outer edge, gradually diminishing in force as the center is approached. Following this principle, a little practice will enable one to take the buckle out of a plate.

Heat-Treating "Caterpillar" Parts

By L. C. Morrow
Managing Editor, *American Machinist*

BECAUSE of the nature of its work, the "Caterpillar" tractor must be made to close tolerances. Ability to resist shocks and abrasion is one of the principal requirements. Hence the heat-treatment of parts, particularly components of the track and track-driving mechanism, must be carried on to high standards, with precise knowledge of the materials being treated, and by the use of equipment that will permit rapid production as well as controlled quality. The methods described are those of the Caterpillar Tractor Co., of San Leandro, California.

Carburizing, of which there is much to do, is carried on according to schedule, in automatically-fired oil furnaces, of the company's own construction. Prepared peach pits are the only carburizing material used. They have been found to give very satisfactory results and to be advantageous because of their light weight. Steel samples of known analysis are put into the pots with the pieces to be carburized; at the end of the carburizing operation the samples are taken out and checked for depth of case before the contents of the pots are hardened. If the samples have the proper case, it is certain that the carburizing operation is theoretically correct. The contents of the pots also must be checked to show that their composition did not differ, beyond established tolerances, from the composition of the samples.

Equipment for Hardening and Testing

Hardening is done in the usual manner in oil-fired furnaces. Among the equipment are four hump furnaces, such as shown in the background in Fig. 5. A Rockwell dilatometer, that can be moved from furnace to furnace, has been installed. It may be seen in the illustration on furnace E1. Great consideration is given to hardness, as evidenced by the testing equipment shown in the headpiece—Brinell, Rockwell and scleroscope machines. All of the gears and ten per cent of the track links are tested. Of the spools and pins a few are tested every half hour as they pass a given point in the machine line.

Much attention has been given to the cooling of quenching water, and the equipment in use for this purpose will be described later, as will special holding devices used in quenching.

Hearth Supported By Hydraulic Ram

A special furnace, Fig. 1, has been developed by the Caterpillar company to harden cast-steel sprockets. The furnace is oil-fired from the top, the hearth is supported on a hydraulic ram, and the capacity is four sprockets per heat. In quenching, the hearth is lowered, a sprocket is pulled from the top of the pile to the inclined rails, and is slid into the hydraulic quenching press, Fig. 2, where it fits into a die, or form having the shape of the sprocket. A ram is then lowered to cover the hub and six small rams descend at the same time against the rim to hold the sprocket against the die. The seven rams are operated from the same pressure chamber, and the total pressure against the sprocket amounts to 30 tons. When the sprocket has been thus locked, the quenching water is allowed to flow over it; the rim and spokes are quenched, and the hub, being covered by the ram of large diameter, remains soft.

No sprocket, however, is fully quenched. The time during which a sprocket is allowed to remain in contact with the water is determined by a study of the analysis of the steel of which it is made. Each sprocket carries a heat number, and the analyses of all heats are furnished the metallurgical department of the foundry. These analyses are virtually furnace tests. Moreover, each sprocket carries a coupon that may be broken off at any time by the metallurgical department, given fracture inspection, and checked for hardness. Chemical

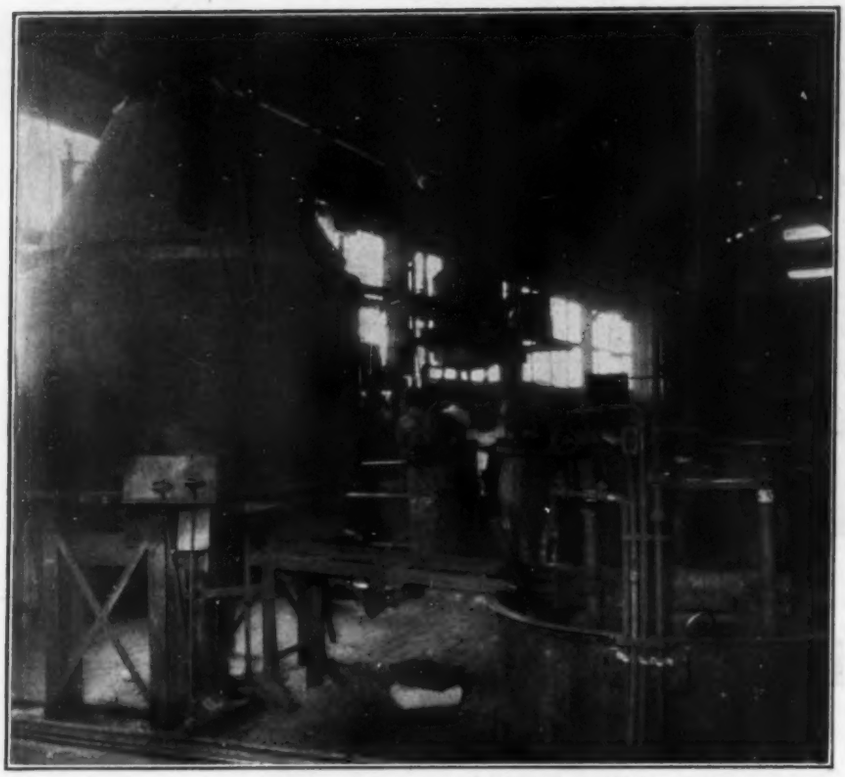


Fig. 1—Furnace and quenching machine for hardening sprockets Oil-fired from top—hearth supported on hydraulic ram—sprockets held in die while quenched—hubs left soft

analysis also is made when necessary. Each sprocket is tested for hardness and records are kept to be checked later against service accomplishment or failure.

The steel used in the sprockets is practically the equivalent of S.A.E. 1245. The Brinell readings sought are 2.9 to 3.3 mm. diameter of impression, numbers 444 to 341. Before hardening, the castings are normalized by being slowly heated to 1,650 deg. F., held at that heat for half an hour, and then allowed to cool in the yard. Since the only machining is that done on the hubs, the machine work is done after hardening.

In Fig. 3 is shown the oil-fired annealing furnace, which is equipped with two parallel tracks, each with a capacity of five 45-in. cars such as illustrated. In the center of the furnace is the combustion chamber, always kept up to annealing temperature when the furnace is in operation. The cars on the two sets of tracks move in opposite directions in steps, a step being the length of one car. Each car is equipped on the bottom with a sand seal, and is mounted on roller bearings. Movement of the cars is controlled by hand. Several of the pieces from each car are given the Brinell test before the lot is allowed to be machined or given further heat-treatment.

The furnace just described is not used for nickel steel, which is annealed in the usual manner. Nickel steels are normalized by the manufacturer to definite Brinell limits, but are further annealed at the Caterpillar plant for machining and for the advantages to be gained in the hardening process.

An unusual feature of the heat-treating work is the support or fixture, used to hold pieces while they are being quenched. The object in using the fixtures is to get away from the old method of dropping the hot piece into a tank or moving it around through the water while held by tongs. With the piece set into the fixture, a plentiful supply of the quenching medium is caused to flow over and around it. The water is returned by gravity from the quenching tanks to a sump to be cooled and then pumped back to be used over and over. Two tractor radiators, as shown in Fig. 4, are used to cool the quenching water. Through them the water is pumped from the sump. It passes from the radiators to the tank shown in the illustration, and thus gains its head. In the illustration, Fig. 5, an example of hardening gears by oil quenching is shown.

Track links must be hardened because they are subjected to wear. At the same time, that edge of the link next to the ground is subjected to great tension as well as shock, and must have greater elasticity than hardening will allow. In the Cater-

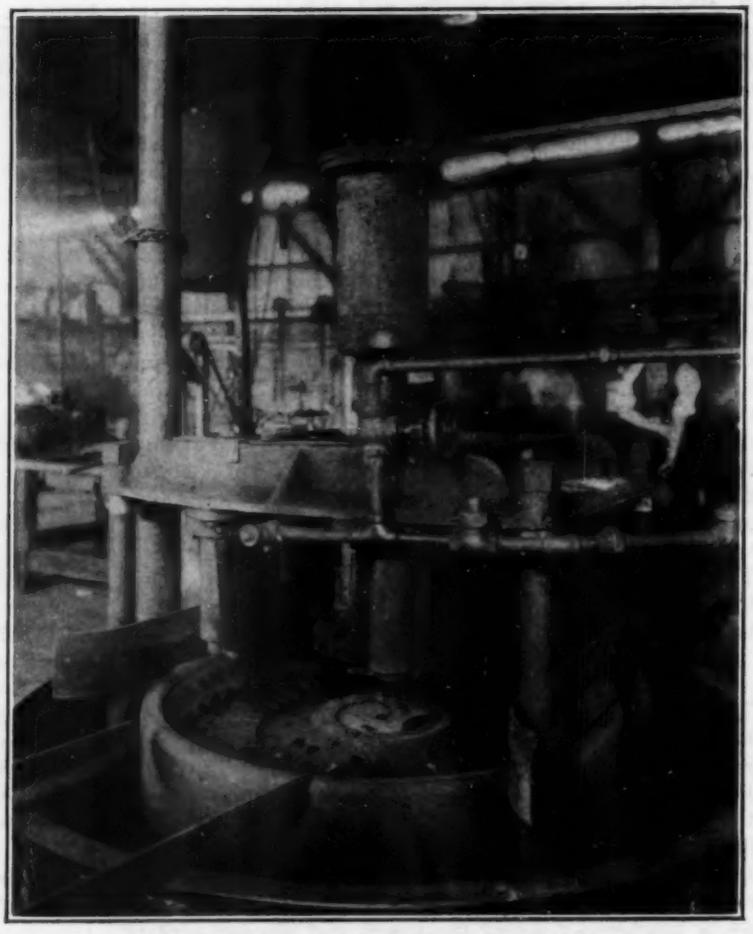
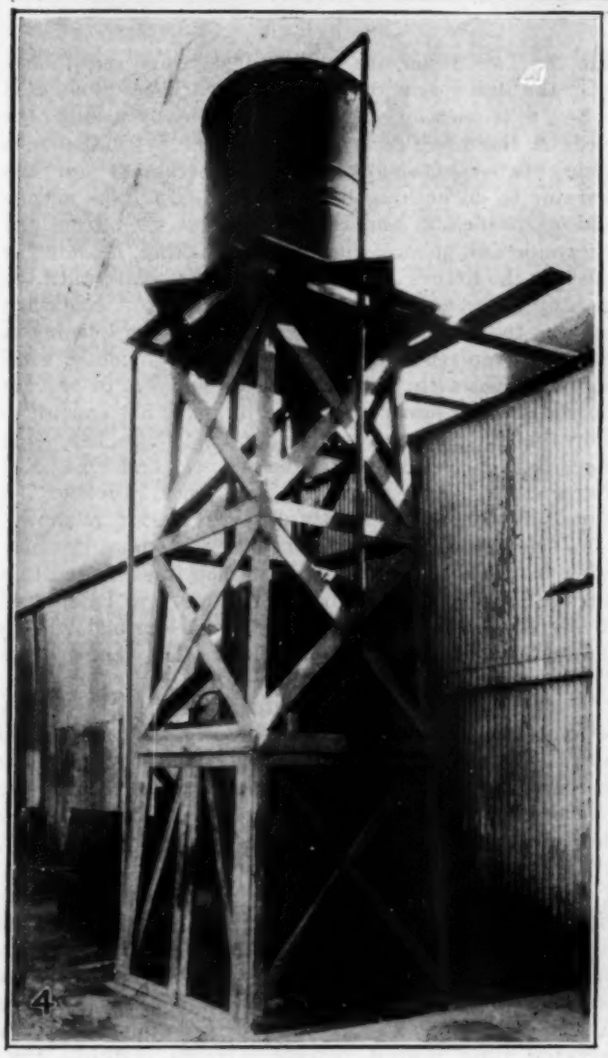


Fig. 2—The sprocket-quenching machine



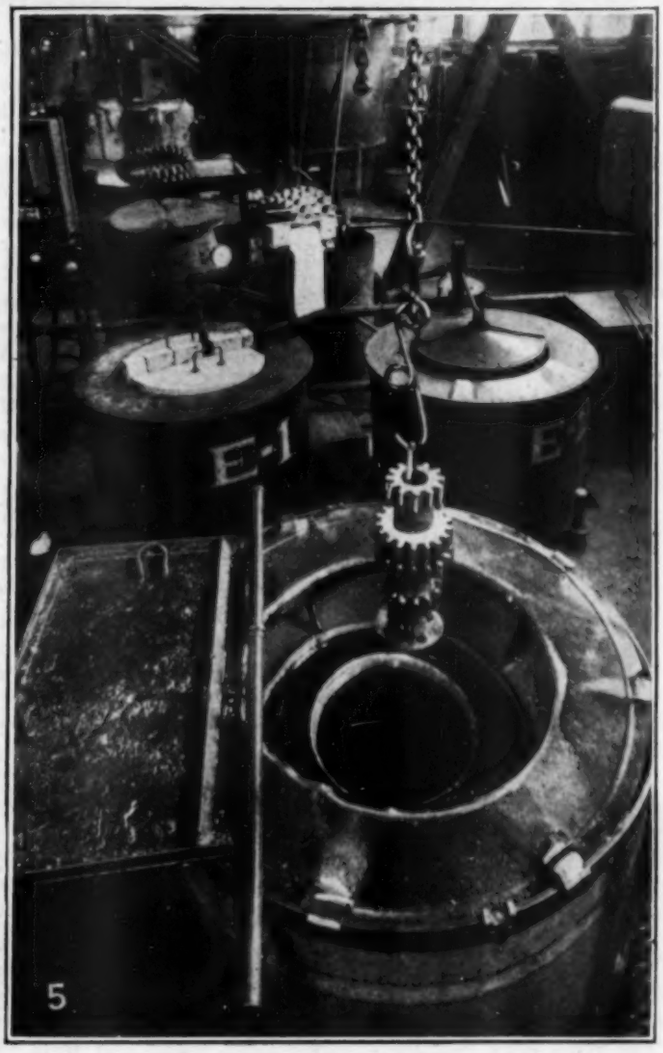
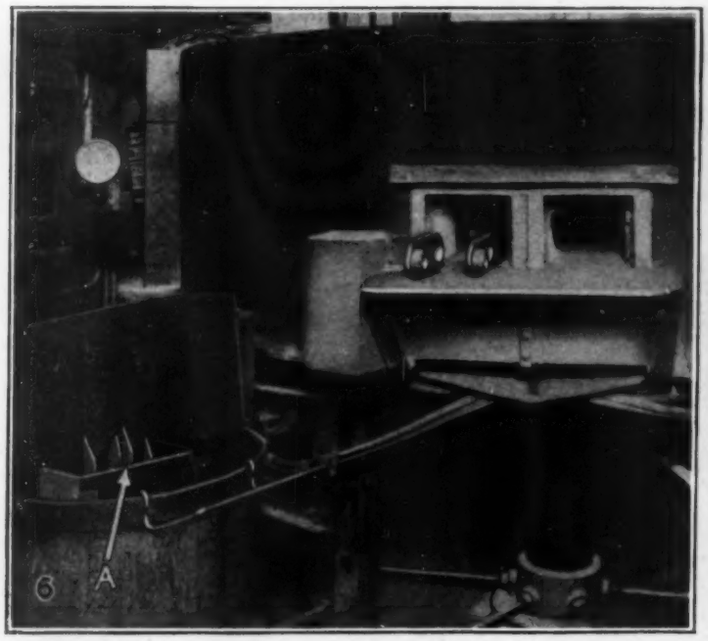


Fig. 3—Annealing furnace with two tracks, combustion chamber in center. Fig. 4—Radiators, pump and tank for cooling and circulating quenching water. Fig. 5—Oil-quenching tank used in hardening gears



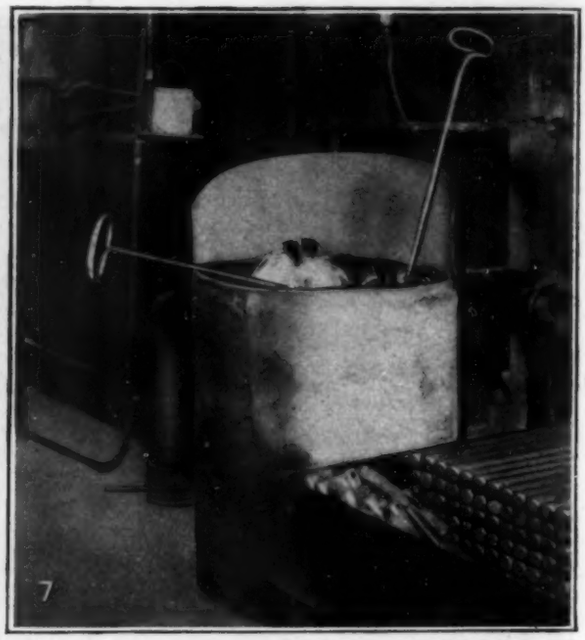


Fig. 6—Electric, automatic, revolving-hearth furnace and quenching tank used in hardening links
Fig. 7—Quenching "fixtures"

CARBURIZING
STANDARD SCHEDULE

HOT

PART NO. S 234 DATE 7/4/26

No. 3-4 Furnaces

Notes

96 per box
3
288 per furnace

4-6:30	1500
7:30	1540
8:30	1580
9:30	1600
10:30	1620
11:30	1640
12:30	1660
1:30	1680
2:30	1700
3:30	17
4:30	17
Out→ 5:30	17
6:30	17
7:30	17
8:30	17
9:30	17
10:30	17
11:30	17
12:30	17

Boxes: 6
F
C
C
R

Fig. 8—Schedule for carburizing furnace

pillar plant the links are heated to hardening heat and are then quenched in such a way as to leave the road edge relatively soft. Both right and left-hand links are passed through the operation at the same time, the necessary attention being given to see that the proper edge of each kind is left soft, and that the two kinds are put into separate containers.

On the link job, a rotary electric furnace, illustrated in Fig. 6, is used. Control is automatic, by means of a Leeds & Northrup recorder controller. With the links being heated automatically, it is necessary for the operator to do nothing but place the cold links on one side of the hearth and remove the hot ones from the other side and quench them. In quenching, he sets the link into the fixture *A*, steps on a treadle, waits until the quenching has been completed automatically, and then removes the link from the quenching fixture, placing it in the proper receptacle. The fixture is made of steel plates, drilled with just enough bleeder holes to prevent the water from flowing over the link, yet not enough to allow the level to sink further than about $\frac{1}{4}$ in. below the edge that is uppermost in the fixture, and which, of course, is to be the relatively soft edge. In Fig. 7 a quenching fixture of slightly different design is shown.

An electric, progressive, drawing furnace is now being installed in the track production line. When this furnace is placed in operation, the links will be entered at one end, after the hardening operation, and will be automatically heated and quenched. The temperature will be controlled by automatic recorder controllers.

The reference to a schedule for carburizing will now be explained. The form shown in Fig. 8 is a schedule for a specific job. The furnace tender follows the instructions as to temperatures and times. It is the function of the foreman, or someone delegated by the superintendent of the heat-treating department, to furnish the schedule to the men.

As a check-up on men and equipment, and to provide data for cost-finding, records of both man-time and furnace-time are kept. The operator, or furnace tender, punches his time on cards—one card for each kind of part, when he is working on two or more at the same time. Likewise, he records furnace-time, charging working time against individual parts and idle time against "idle furnace—hot" or "idle furnace—cold." Records kept for the full 24 hours per day show the costs of production, shut-down, waste fuel and used fuel.

Heat-Treating Axe Bits by Electricity

By Cranston H. Carpenter
Westinghouse Electric & Manufacturing Co.

The use of an electrically-heated lead bath permits accurate temperature control—Description of the apparatus and the results obtained

IN CO-OPERATION with the engineers of the Westinghouse Electric & Manufacturing Co., the Kelly Axe & Tool Co. of Charleston, W. Va., has completely equipped its axe room and small-tool department with electrically-heated furnaces. Twenty-three heat-treating furnaces, consuming 1,156 kw., and four low-temperature furnaces, consuming 640 kw., are installed. Of the heat-treating furnaces, seventeen are for hardening and six for drawing. They are all of the lead-bath type in which a nickel-chrome vessel is supported in an insulated boiler-plate housing of the pit type. Fig. 1 shows the complete unit with the vessel elevated from the heating chamber and the top protection placed alongside. There are two different size baths for hardening, and four input ratings according to the application and the temperature requirements. The larger furnace has external dimensions 94 in. long by 34 in. high by 48 in. wide. The heat insulated wall is 13½ in. thick and consists of 9 in. of C-22 cement and 4½ in. of Sil-o-cel brick. The heating chamber is approximately 20 in. wide, by 66 in. long. On the walls are located the ten heating elements of No. 1 B. & S. nickel-chromium rod. There are two circuits permanently connected in parallel for single-phase operation on 220 volts. The normal input rating is 62 kw. The nickel-chromium vessel hangs upon the inner edge of the brickwork by a flange extending around the perimeter. The vessel is 12 in. wide, 14¾ in. deep and 60 in. long at the top and at the bottom 48 in. long. There is also a slight taper crosswise, giving an inside dimension at the bottom of 11 in. The flange on which the vessel rests is 3⅜ in., giving a good support for the vessel on the brick wall. The cast nickel-chromium protecting plate, made in two sections, overlaps the flange of the vessel so that any slop or spill in handling the work is drained back into the bath, and is not permitted to reach the brickwork. The cast vessel weighs 675 lb. and holds about 3,500 lb of lead. A longitudinal channel about 6 in. in width and 4 in. in depth is provided in the bottom of the heating chamber so as to drain off any lead that might leak into the heating chamber in case of failure of the nickel-chromium vessel.

A lead bath provides a medium that is very satisfactory for heat-treating tools that are not too complicated in design. Its most valuable property is the ability to transfer heat quickly—about sixty times the speed of direct radiation at 1,500 deg. F. The bath also prevents the formation of scale by submergence during heating

The heating element terminals are brought out at one end and are protected by a perforated sheet metal box. A thermocouple extends into the heating chamber and is supported by an open-end nickel-chromium tube so that it cannot droop and change its location. Another thermocouple is immersed in the lead bath.

The small hardening furnaces used for hatchets, mechanics' hammers, and tools of various kinds are rated at 26 kw., single-phase, 220 volts; the overall dimensions are 52 in. wide, by 81 in. long, by 35 in. high, and these furnaces are equipped with a nickel-chromium vessel 46 in. long at the top, tapering at the bottom to 34 in. with a bottom width of 11 in. The vessel has a 3½-in. flange and a top width of 12 in. The inside depth is 12½ in. The vessel holds about 2,400 lb. of lead and empty weighs 350 lb. There are eight No. 1 B. & S. nickel-chromium rod elements mounted on the sides only and connected in two parallel circuits for operation directly on 220-volt alternating current.

The drawing furnaces are exactly similar in constructional details except for the heating elements, which are designed for 47 kw. input. The heating elements are connected for single-phase operation at 166 volts, and they consist of two parallel circuits. The correct terminal voltage is obtained by the use of an auto-transformer. Considerable economy was effected in designing the drawing furnaces for temperatures of 600 to 800 deg. F. by using the same parts as for the larger furnaces.

A lead bath provides a medium that is very satisfactory for heat-treating of many tools and parts that are not too complicated by reason of sharp corners, thin flanges, fillets, small holes, fine ridges, and the like, which take up or retain particles of the lead. The most valuable property of the lead bath is the ability to transfer its heat very quickly to steel parts that are either partly or wholly submerged in the bath. At temperatures around 1,500 deg. F. the speed of transfer is about sixty times that of direct radiation from the heat source and walls in a box-type furnace. Another most valuable property is the prevention of scale or oxide forming on the steel due to exclusion

of the atmosphere by submergence during heating. The fact that iron floats in a lead bath is also a property of considerable importance in heat treating of small pieces, and it is possible to support pieces to be heat-treated in convenient positions by making use of the hydrostatic head of lead. Another advantage is the large heat storage that can be obtained in a properly

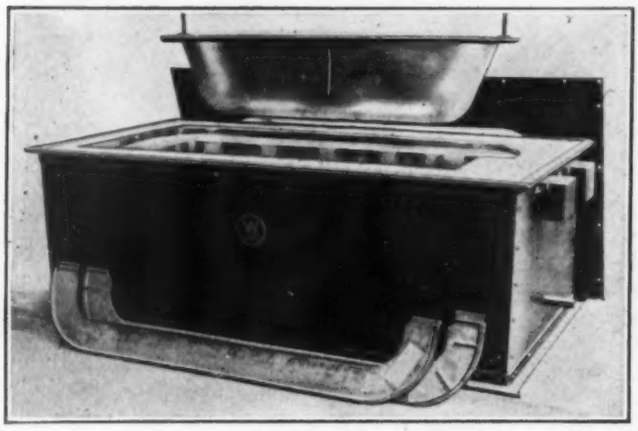


Fig. 1—Electrically heated lead-bath furnace

designed furnace. A relatively small weight of tools going cold into a lead bath at the hardening temperature does not lower the temperature of the lead appreciably.

The hardening production of the Kelly Axe & Tool Co. is handled by eight 62-kw. furnaces operating at about 1,500 deg. F., according to the type and size of axe being treated. With a 4½-lb. axe, only about 2 lb. of metal is heated to this temperature as it hangs from the individual hook, as shown in Fig. 2. Handling operations in this plant are entirely manual under present operating conditions. Each of the twenty hooks are first loaded, quickly coming up to bath temperature, and are then removed one at a time from the starting end and promptly quenched in a brine tank. The axe is then passed through clean water for washing and placed on the truck awaiting the drawing operation. A cold axe is then placed on the first hook, and the axe two hooks away is removed and quenched and then passed through the previously mentioned operation. The operators aim to keep two spaces between the cold axe coming off, so as not to chill the lead in the vicinity of the hot axe. This operation is continuous through a row of twenty hooks.

The maximum production of 4½-lb. axes is about 236 per hour, and on 6-lb. axes about 180. The hooks of the hardening furnace are spaced about 2½ in. apart so that about 1 in. clearance is left between the heads of each axe when hanging through the eye on the hook above the bath. With a production of 236 axes per hour, the twenty hooks are filled and emptied 11¾ times. Although the quenching is at the rate of nearly four axes per minute, each 4½-lb. axe is actually in the bath about 4 min., 36 sec., and each 6-lb. axe about 6 minutes.

On the 4½-lb. axe, an economy of 18 lb. per kw.-hr. was obtained in a test run on 4,409 lb. of axes over a time interval of 7 hr. 50 min. The 4,409 lb. represent the total weight of steel.

The drawing operation on these axes is handled by six drawing furnaces, manually operated in the same way, except that thirty hooks are provided so spaced that there is ¼ in. clearance between adjacent axe heads. Although these furnaces have the same physical dimensions as the hardening units, the input is 47 kw. for operation at 800 deg. F. This furnace draws at a rate of 314 and 240 axes per hour. The 4½-lb. axe is in the bath 5¾ min., and the 6-lb. axe, 7 min. In actual production the economy is 54 lb. per kw.-hr. on a basis of 4½-lb. axes raised to an average temperature between 340 deg. F. and the drawing temperature. Six drawing furnaces readily take care of the eight hardening units. On the basis of the present production fourteen men are required to handle the work in and out of fourteen furnaces. A foreman supervises operations and takes care of the control and pyrometer maintenance.

For the smaller run of tools such as hatchets, hammers, and scout axes, three small lead-hardening furnaces are employed. Their general design features follow closely those of the larger units. The overall dimensions measure 52 in. wide, by 80 in. long, by 34 in. high. Owing to the diversity of tools forming the mill run of products heat-treated in these furnaces, it is necessary to sort the material for checking the production rated on this size of furnace. The work that is handled in these furnaces is of varying sizes and weights and many different patterns and no attempt was made to obtain a production rate per kw.-hr. on this size of furnace. It is interesting to note that the tool room started with one 30-kw. electric furnace, which has since been remodelled to conform in size with the 62-kw. furnaces as far as physical dimensions are concerned. Three 62-kw. furnaces exactly similar to those in the axe room, three 26-kw. furnaces of the small dimensions mentioned above, and two 42-kw. furnaces of the same physical dimensions as the larger 62-kw. pots have been added, the last two quite recently.

Each furnace is controlled automatically within plus or minus 5 deg. by means of a Leeds & Northrup controlling and recording pyrometer that actuates a suitable contactor panel. Both units are located in a central control room and are protected from dirt and

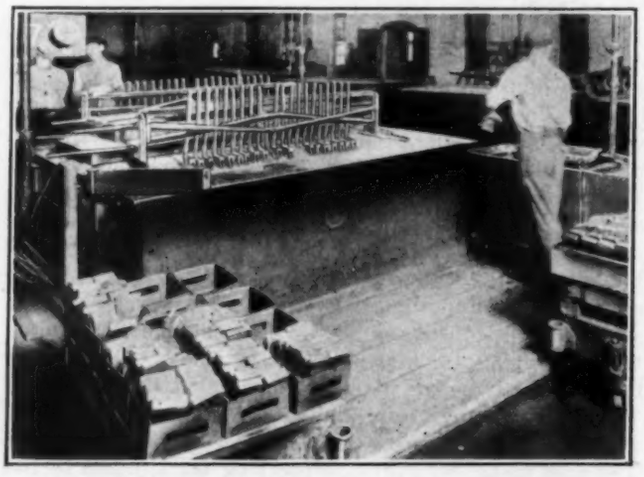


Fig. 2—Heat-treating axe bits in a lead bath

possible injury. A temperature deviation indicator located near each pot provides the operator with an indication of a temperature variation from the desired or correct bath operating temperature. With a given temperature setting only one rate of work is possible for the operator. If the operator is working too fast and thus does not allow proper time for tool in bath,

the deviation indicator registers the bath at too low a temperature. If the operator is working too slow, the indicator shows too high a temperature. With properly designed equipment, it is possible to set a definite rate of production and it is up to the operator to keep the deviation needle in the zero position.

In a lead-bath type of furnace the primary source of heat loss is the radiation from the surface. During operating hours these baths are covered with about an inch of fine granulated coke, and at night provision has has been made for a portable brick cover supported in a steel frame that rests tightly on the flange. This cover cut the radiation loss to a minimum during the holding period from 5 p.m. to 7 a.m. and over weekends. In order to determine the value of these covers, tests were made on the large 62-kw. pots with an average input of 57 kw. at 1,460 deg. F. Without either coke or brick cover the loss amounted to 37 kw.; with the coke blanket it was only 15 kw.; and with both coke and brick covers it was reduced to 6.5 kilowatts.

With an average input of 54.5 kw. and starting with a temperature of 460 deg. F, it is possible to raise the bath to 1,440 deg. F. in 2½ hr. with no cover on the large pot. With a coke cover the time is reduced to 1 hr. 55 min., and with both coke and brick cover to 1 hr. 50 min. On the drawing furnace of the same physical dimensions with an input of 34.5 kw. the temperature can be raised from 200 to 640 deg. F. without a cover in 1 hr. 50 min., and with a coke cover this time is reduced to 1 hr. and 30 min. These temperatures represent a 12-hr. shutdown with the coke and brick cover on the pot.

Are Profit Ideals High Enough?—Discussion

By Norman J. Gould

President, Goulds Pumps, Inc.

To my mind the suggestion that profits should amount to 100 per cent of conversion cost is very broad and probably could not be applied to the business of an average manufacturing company, as the varying and unknown quantities that enter into such a formula or equation are too uncertain to warrant the assumption that was made. I concur in the statement on page 191, Vol. 65, to the effect that an industry or project should have a proper cost system. The limits to the range of such a system might be a farm at one end and a large manufacturing or railroad corporation at the other.

You may not have had brought to your attention the the "standard accounting and cost system" which was adopted some years ago by the Machinery Builders Society of 50 Church St., New York City, whose membership comprises many leading manufacturers in varied types of industry, and also you may not be familiar with the very simple and comprehensive form of keeping accounts which the U. S. Department of Agriculture prepared for free distribution to farmers during the past few years.

My experience as a manufacturer and business man leads me firmly to the belief that the matter of overhead expense is overlooked by a large percentage of dealers and those conducting small industries, and that if the matter presented for discussion could be widely disseminated great benefit would accrue to the conduct of business throughout our country.

Seen and Heard

How much spoiled work?

By John R. Godfrey

SPOILED work, or scrap, is a tender subject in most manufacturing plants. If you ask a manager what his percentage of scrap is, he's pretty apt to say that it's "very low" or "not worth mentioning." And he may believe it. It's frequently much larger than anyone in the shop dreams. Not so long ago a friend of mine took charge of an old plant that had an excellent and well-deserved reputation for good work. All the shop executives told him the same story, and most of them believed it, too. But in order to see just what the spoiled work really amounted to, he had each department pile all its scrap in one place, and let it grow for a week.

The piles grew until all realized that too much work was being spoiled in all departments and steps were taken to correct the trouble, after studying the reason for so much spoilage. To still further impress the men with the loss due to their spoiled work, the next move was to tag each piece with the cost of the material and labor on the piece. Then the overhead and loss due to delays in production were added. The combination of these costs not only gave the men a shock in the way of total costs, but also impressed them with the fact that labor and material were not the only items entering into the final cost of a piece.

Closely connected to spoiled work is the question of salvage. In some cases much money is lost by not salvaging certain parts, and in others the salvaging costs more than the piece warrants. Both rejected parts and salvage tie up with inspection and bring us to the question of tolerances, that are often unnecessarily close.

Where a "tenth" is necessary, we all agree that it should be demanded. But in too many instances we find a tolerance of a thousandth on a part when a sixteenth of an inch is sufficiently accurate.

There are also many "borderland" cases where it seems best to put on a tolerance of say 5 or 10 thousandths, when in reality 15 or 20 thousandths would not affect the value of the part. The 5-thousandth tolerance is partly because we want to keep the men keyed up to the habit of accuracy.

But after the piece has been rejected by the regular inspector, it might well go to a salvage department where an inspector with judgment on non-essential dimensions could pass the piece without further work on it. In other cases a slight operation might easily put in in the usable class. And it is just as much of a crime to throw away work that will give perfectly good service, as to pass a piece that should go to the scrap pile.

The buyer frequently adds much to the cost of selling. Every time he keeps a salesman waiting for an audience he adds to the cost of the sale. The demand for engineering data makes the cost of selling mount higher and higher. Encouraging firms of doubtful reputation to compete with those of known quality products also adds to the sales costs.

Book Reviews

Aircraft Power Plants. By Edward T. Jones, Robert Insley, Frank W. Caldwell and Robert F. Kohr. Two hundred and eight pages, 5¾x8¾ in. Published by the Ronald Press Co., New York. Price $4.25.

This is one of the volumes that is to form an aeronautic library, the contents devoted to engines, propellers and water ballast recovery for airships. All of the authors are directly connected with the industry, Mr. Jones being chief engineer of the Wright Aeronautical Corporation and the others with the army and navy air services. The three sections of the book are clearly and concisely written. Though not profusely illustrated, the leading types of engines are shown and two makes of carburetors given in detail. Performances of engines, fuels, lubrication, accessories and such auxiliaries as radiators, reduction gears, reversing mechanisms and superchargers are given attention.

The sections on propellers and water ballast recovery, while of less interest to *American Machinist* readers generally, will be found useful for reference.

English Applied in Technical Writing. By C. W. Park, Professor of English, College of Engineering and Commerce, University of Cincinnati. Three hundred thirteen pages, 5½x8 in., cloth boards. Indexed. Published by F. S. Crofts & Co., New York City. Price $2.25.

This volume is intended as a textbook for engineering students, but is well presented for the use of anyone who has to do with technical writing. The author recognizes the fact that technical men are so generally matter-of-fact that they frequently fail to appreciate touches of style in writing, with the result that engineering writing is too often cold, severely practical, and unimaginative. The engineer, also, is prone to mass together in his writing all of the details and complications of his subject, making it difficult of interpretation to others.

In twelve chapters the book treats of such subjects as the point of view, logical organization of material, grouping of statements, the clear statement of ideas, and the accurate use of words. The chapters are easily readable, the material is well arranged, and examples are given to fix the points in the reader's mind. The book is not an advanced text on grammar and composition, but is a logical presentation of the subject of putting ideas on paper intended for the use of engineers who have to meet this requirement in their daily work.

Aircraft Year Book 1926. Three hundred and thirty-one pages, 6x9 in. Published by the Aeronautical Chamber of Commerce, New York. Price $5.25.

No one who wishes to keep abreast of aircraft development can afford not to have a copy of these yearly volumes where they can be referred to readily. And no one who looks them over, even casually, can fail to be impressed with the steady growth of aviation in this country. For, while there has been little to attract public attention, except perhaps the additional air mail routes, there has been a steady growth in actual commercial flying. That safety has greatly increased is evidenced by the comparatively few accidents that are published in the newspapers.

In addition to the sections covering aviation development in this country, 51 pages are devoted to a review of aëronautics throughout the world, so that anyone can readily find how much, or how little is being done in other countries. Technical development receives careful attention, both as to planes and other apparatus.

The use of aircraft in exploration, agriculture, forestry, mapping and other branches of our diversified lines, is also cited.

The section on Aircraft and Engine Design is of value as a quick reference for all interested and the appendix contains a list of landing fields, distances and other pertinent facts.

Second Report of the Gas Cylinders Research Committee, Periodical Heat-Treatment. Published by the Department of Scientific and Industrial Research, 16 Old Queen St., Westminster, London, S.W.1. Twenty-nine 6x9½-in. pages of text and seven inserted pages of halftone illustrations. Paper covers. Price 2s. 6d. This booklet contains the results of a series of special investigations conducted since 1921 on the periodical heat-treatment of steel cylinders. The periodic heat-treatment of gas cylinders has been officially indorsed since 1895, but the committee has now reached the conclusion that the practice serves no useful purpose. The reasons are set forth in the pamphlet, together with a detailed discussion of each test made. The effect of re-annealing and of re-normalizing overstrained specimens of 0.25 and 0.45 per cent carbon steel is carefully considered, and the pamphlet makes a valuable addition to the subject of heat-treating.

Unemployment in Columbus, Ohio, 1921 to 1925. By Frederick E. Croxton. Published as Bulletin No. 409, Employment and Unemployment Series, Bureau of Labor Statistics, Washington, D. C. Thirty-five pages, 5¾x9 in.

This pamphlet contains completely summarized data on the results of employment studies made in the city of Columbus by the Mayor's Emergency Unemployment Committee. One-half of all persons enumerated were in the manufacturing and mechanical industries, and the booklet forms an interesting study of the labor situation in an average city during a period of business depression and subsequent recovery. Statistical tables are given, showing in detail the industries and classes of labor affected.

Year Book and Register of British Manufactures, 1926. Edited by W. S. Barclay and Ernest A. Nash. Published by the Federation of British Industries, 39 St. James Street, London, S.W., 1, England. Six hundred eighty-eight 7x9½-in. pages, cloth boards. This annual directory is claimed to be the leading reference to goods manufactured in Great Britain. It contains lists of British manufacturers arranged alphabetically under the names of the products manufactured. It also has a full alphabetical list of the member firms of the Federation of British Industries together with their addresses and pertinent information relating to the firm. In the front of the book is an outline of the class of free services rendered by the Federation, and in the back are more than two hundred illustrated advertising pages of British industries.

Automotive Production

Heat-Treating Axle Shafts by Special Machinery

By Frank C. Hudson
Editor, *American Machinist*

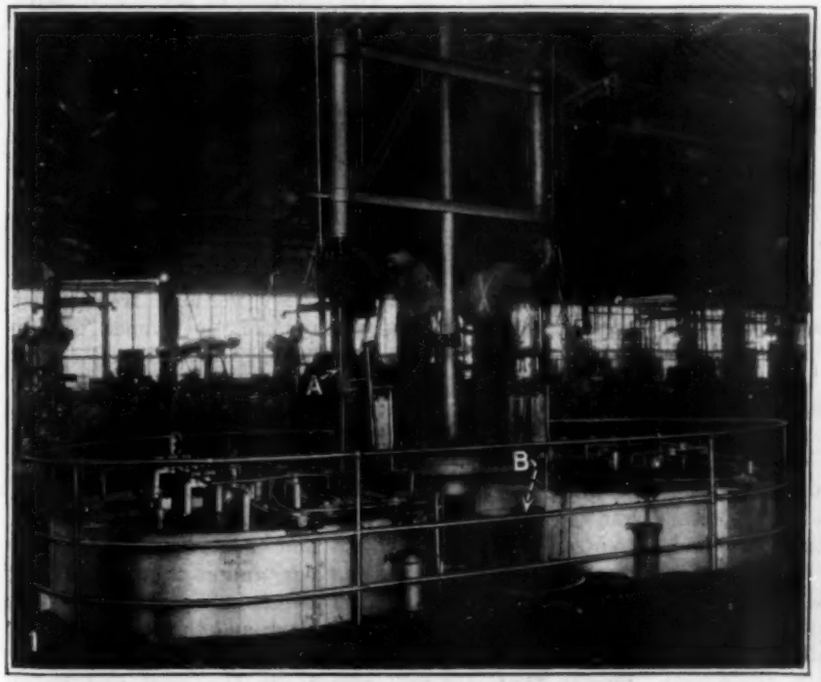
Electrically-heated furnaces with air-operated devices for placing and removing work—Mechanical quenching—Automatic timing of work in the furnace

THE method of heat-treating axles in the Oakland plant is both unusual and impressive. The equipment was specially designed for the work by the George J. Hagan Co., Pittsburgh, Pa. It consists of two round electric furnaces and two quenching tanks.

One furnace is for heating for hardening and the other one is for drawing the work to the desired temperature. The furnaces are shown in Fig. 1 and a close view of the tongs can be seen in Fig. 2. The furnaces are in the machine line in accordance with the sequence of operations. Shafts come to the heating furnace after rough machining to remove all excess metal while they are soft. The heat-treating brings them up to 302-340 Brinell hardness after which they are straightened if necessary, and ground to a finish. The method of heat treating, however, usually makes straightening unnecessary.

A soft shaft is picked up by the tongs *A*, Fig. 1, in the air-operated hoist, carried to the proper opening and lowered into the furnace. The furnace holds 60 axle shafts, which remain long enough to acquire the proper heat, traveling slowly, so as to come back to the next opening in one hour. The hoist is then swung to the next opening and a heated shaft removed and quenched in a revolving tank on the other side of the furnace.

The shaft remains in the quench until it reaches the next opening, when it is removed and lowered into the drawing furnace where it remains a given length of time and is then removed and lowered into the second



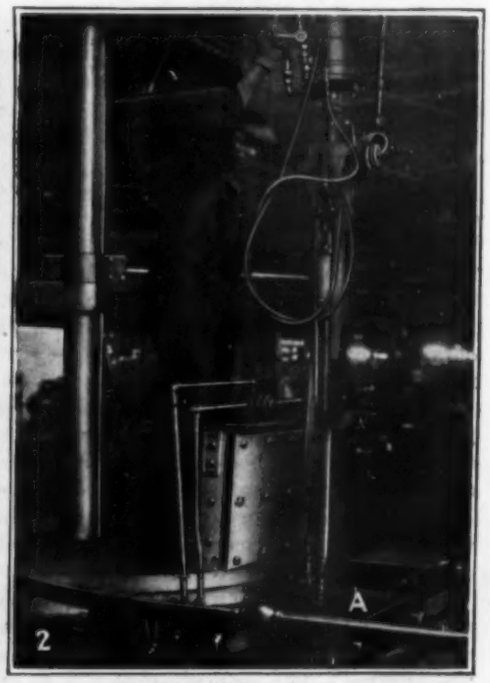


Fig. 1—Hardening and drawing furnace. Fig. 2—Putting a shaft in place

Automotive Production

quenching bath at *B*, completing its treatment. The furnaces are so timed that a rough-turned shaft goes into the heating furnace and a treated shaft is removed every minute, or at the rate of 60 per hour. The operation means quick and continuous work on the part of the operator, but a trained man has no difficulty in maintaining this schedule. Although two men are shown in Fig. 1, one man can handle the one-a-minute output after a fair amount of practice. A better view of the air-operated tongs and the cover is shown in Fig. 2. The cover *A* is moved to either side to allow the axle to be either dropped in place or removed.

The cover is operated by air and controlled by the operator's foot, so that he can uncover either opening at will, and, on releasing his foot, the cover slides back over both openings. The shafts are held in the furnace vertically by castings made of a nickel-chromium alloy, built up in eight sections of six pieces each and linked together to form an annular ring. The shafts are held 2½ in. apart, and the carrier indexes this amount at each movement so as to present either an empty holder or a shaft ready to come out, to the operator. The alloy castings stand the heat of the furnace with practically no distortion.

The carrier revolves on one inch balls, and is so designed as to be easily repaired in case of necessity. Water for quenching is kept at 180 deg. by a Powers regulator, although it circulates at the rate of 75 gal. per minute. Before starting operations, steam is used to heat the water, the regulator shutting it off at 180 deg. When quenching begins and the temperature rises, the same regulator admits cold water as needed, the hot water displaced going to the sewer. The quenching tank has a bottom drain for flushing out scale.

The Brazing of Metals—Discussion

By E. Darwell
St. Albans, England

HAVING read the series of articles by A. Eyles entitled "Soldering, Brazing and Riveting Sheet Metals," published in Vol. 64, of the *American Machinist*, I should like to add a few remarks regarding the brazing of metals. As regards the value of a brazed joint—particularly if made by the open-fire method, a high degree of skill on the part of the workman is required, since the spelter generally used melts at a point but little below that of the metals being brazed.

There are several distinct methods of brazing in use: Dip, torch, electric, open-fire, etc., and the one that should be selected depends upon the conditions and requirements of the work in hand.

In dip brazing, a bath of molten spelter is used. The parts to be brazed are preheated and then submerged in molten spelter until they are united. The molten spelter should be covered with a layer of fused flux to a depth of about one inch. The flux almost universally used is borax.

To prevent adherence of the spelter to other parts of the work, a mixture of molasses and graphite should be painted on, as required, but great care should be taken to keep the mixture out of the joints, otherwise their strength will be seriously impaired.

In electric brazing, the results are superior to those obtained by open-fire or torch brazing, particularly with non-ferrous metals.

It is very much easier to control the temperature of the work when heating it electrically, since the actual color can be seen better than if surrounded by flame, and the speed of heating can be controlled to a nicety. Flux is placed on or around the joint and the spelter added, either at the moment its melting point is reached, or before, according to the size and kind of work.

Holding jigs play an important part in this process, particularly where the proportion between the size of pieces to be brazed is great or where their resistances are unequal. The primary object is to raise the whole of the metal in the neighborhood of the joint to an even temperature, otherwise the spelter would flow on one and not on the other, or one piece of work would actually melt before the other was hot enough, or one piece would take much longer to come up to brazing temperature while the other was at a red heat practically the whole time, oxidizing rapidly. There is another important factor where the articles to be brazed are very dissimilar in size or mass, and even in cases where it is impossible to quite balance the rate of heating by other means, it is often possible to do so by slow heating and arranging for the rapid dissipation of the heat generated in the smaller object while the larger object is heating up. The question of the contact area of the jigs is important, particularly on large articles and where it is essential that overheating should not take place. It is necessary to keep the jigs clean.

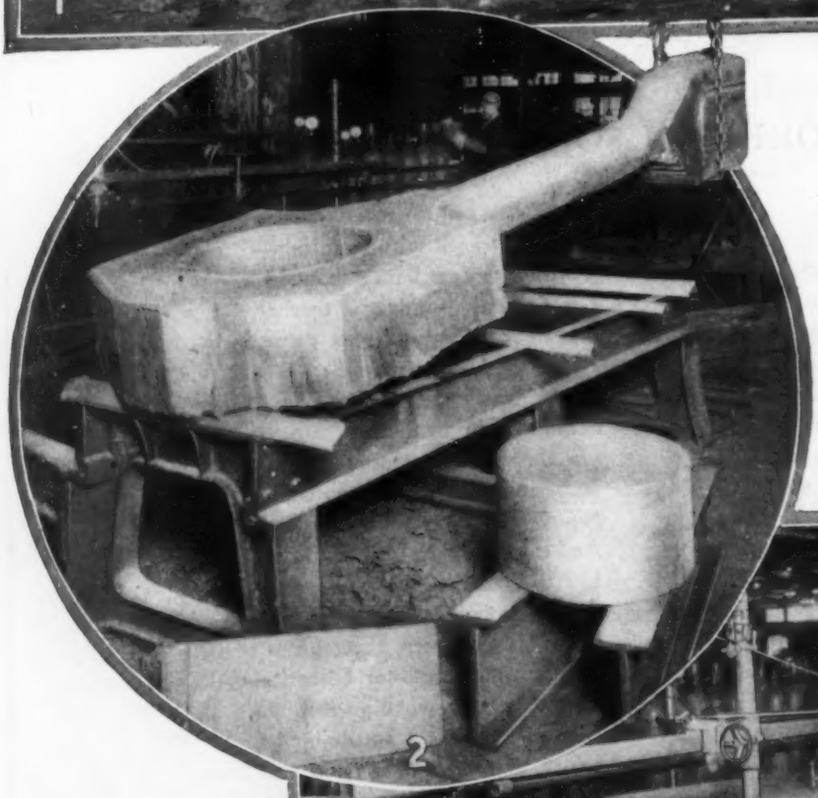
The Hyde brazing process is different from the ordinary processes in that hydrogen is used as the flux and copper as the brazing material. The point at which brazing is carried out is covered by a cowl or other chamber, and hydrogen is led in during the moment the melting point of the copper is reached. The surface need not be cleaned, since the hydrogen reduces any rust or scale to the form of spongy metallic iron, which presents an admirable surface for the copper to penetrate. The fluidity of the copper melted under such conditions is extremely high and it spreads over the surface of the iron, penetrating the minutest crevices.

In electric brazing by this process, the cowl or chamber into which the hydrogen is led is usually arranged to fit in between the electrodes or jaws of the jigs, and to completely cover the joint. A small mica window is often set in the cowl, so that the temperature of the work can be judged by its color, and so that the current can be cut off at the right moment. In some cases the cowl can be placed over the work and the underside left open for inspection of the joint. The hydrogen being lighter than air will remain in the cowl and be all about the joint. The consumption of hydrogen is small.

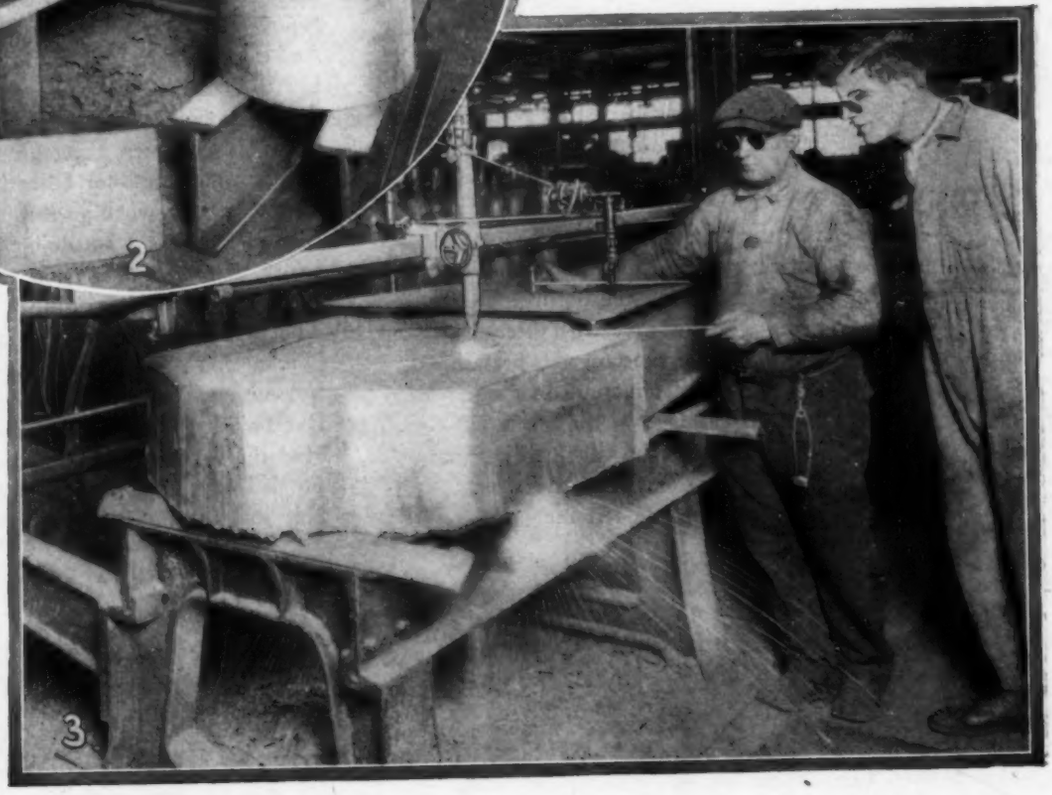
THE FOREMAN SOLILOQUIZES

By Loring Roper

I'm the guy they call the foreman,
He's the chap out in the shop
Who keeps the wheels a-turning,
Starts 'em up whene'er they stop.
In some shops I'm called a tyrant,
Others treat me as a clerk
Who runs errands from the office,
Watches other fellows work.
In some shops I'm just a buffer
'Twixt the shop men and the boss,
Others take me for a stock clerk
Guarding pilfering and loss.
Now-a-days my back they're patting
Handing me all sorts of guff,
Hiring college men to train me
How to better "do my stuff."
I'm the "key man" of the outfit,
All the works depend on me—
I am "managing the business"
Some are telling me with glee.
But, whene'er the boss gets peevish,
When his golf ain't up to form,
He still calls me in the office
When he wants to rave and storm.
Still the personnel man nags me,
Still the planners tell me how
I must set each job of milling—
To their orders I must bow.
I must be the guide and teacher,
I must *lead* my men, not *drive,*
I must get co-operation
As the bees do, in the hive.
Some say I'm of greatest value,
Others think I'm just a dub,
Some that the whole shop is swinging
Round about me, as the hub.
And for this, my compensation,
For the most, is just a wage,
That's no bigger on the payroll
Than the best men I engage.
I ain't grouching—for I like it—
Like to see the work go through,
Like to feel that I am doing
Work that's real, and good, and true.
I'd be glad of any training
That will teach the thing I lack,
'Tis my job—and I am for it—
I'm not one for turning back.
But I wish the high-brow artists
Had the "goods" instead of bunk,
For it's *facts* and *help* I'm needing,
Not just theoretic junk.



How Money Was Saved by Flame Cutting



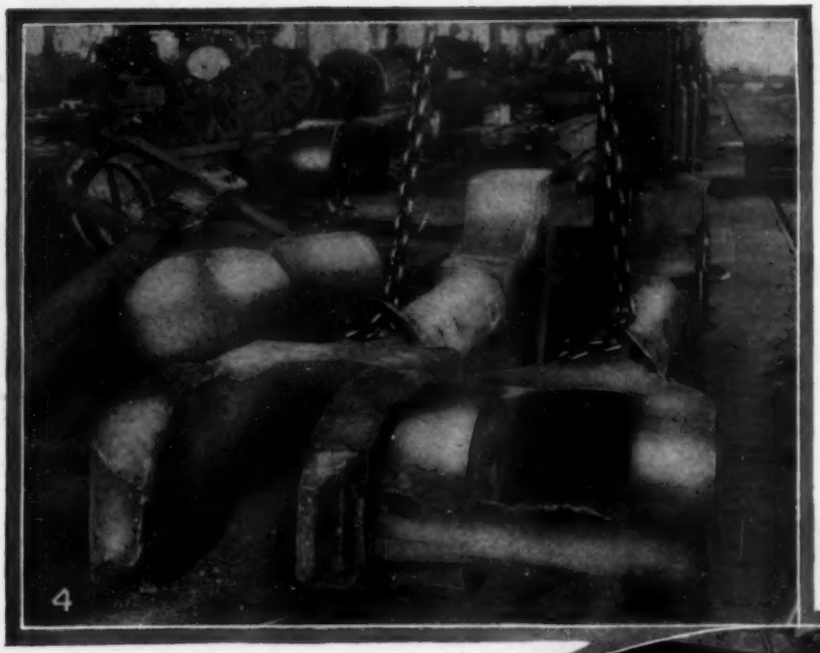


Fig. 1—Blanks for pistons cut from bar of forged steel. Diameter 25 in. 0.45 per cent carbon

Fig. 2—Rod rough shaped by torch. Block left in forked end for inspection. Note blank removed from large hole

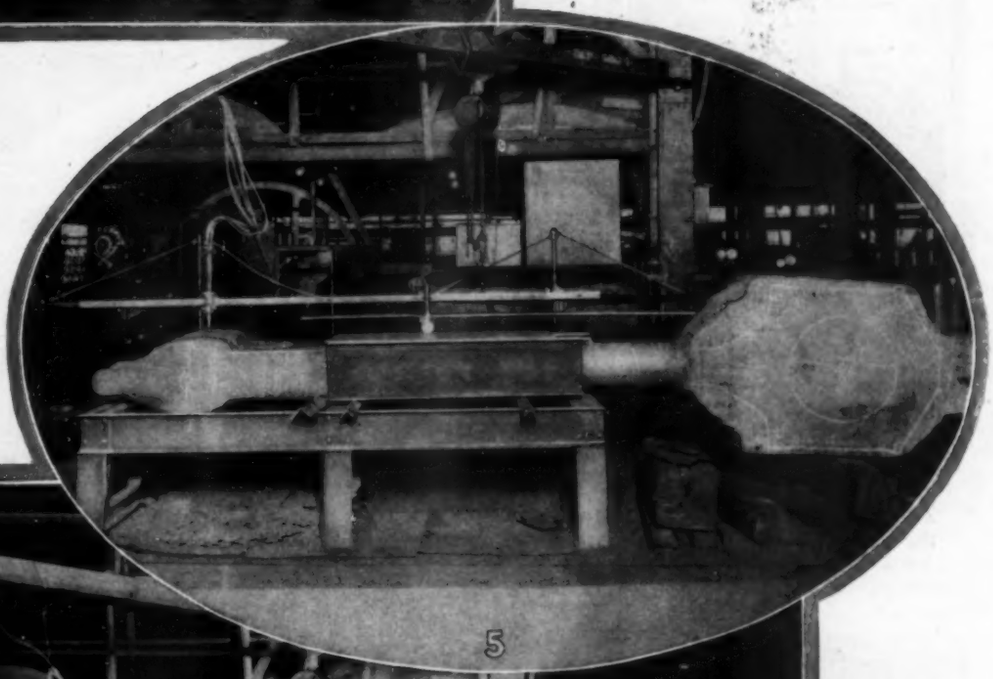
Fig. 3—Using radius attachment to cut 22-in. hole

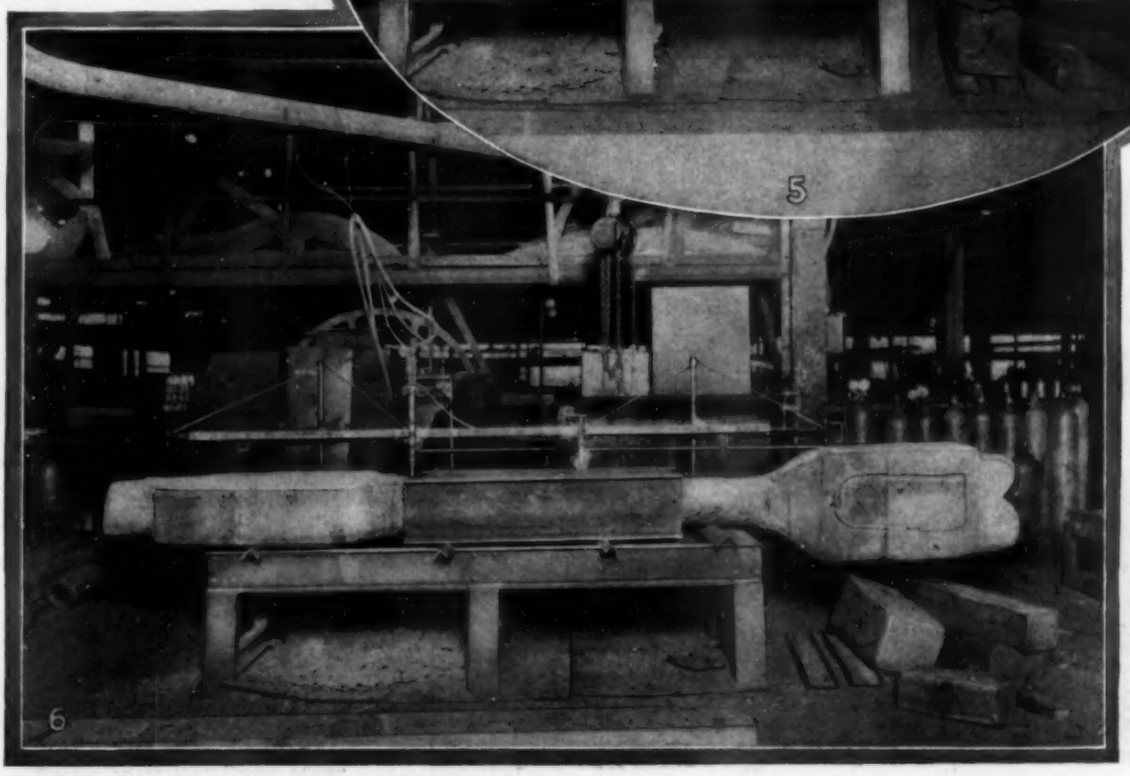
Fig. 4—A pair of large Diesel rods weighing about 13,000 lb. each. Tie across end is for lathe center, cut away after turning

Fig. 5—Rod laid out and in machine for cutting. Thickness varies from 6 to 16 in. Pattern is under tracing wheel

Fig. 6—Cutting crankpin end. Hole is 22 in. in diameter, rod 12 in. thick

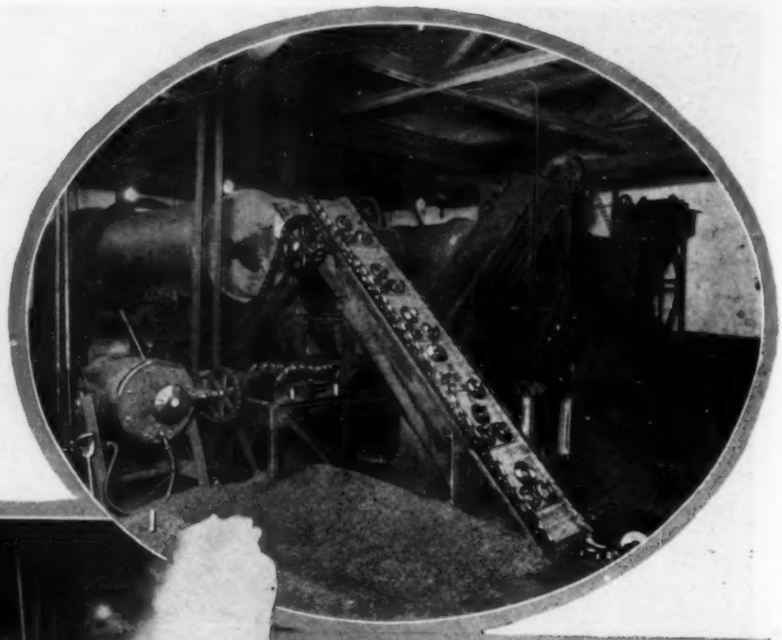
A forge shop had an order for connecting rods that were too large for its equipment to forge to a size for economical machining. Instead of buying new forging presses, an oxygraph apparatus was put in and the forgings were cut to machining sizes as shown.



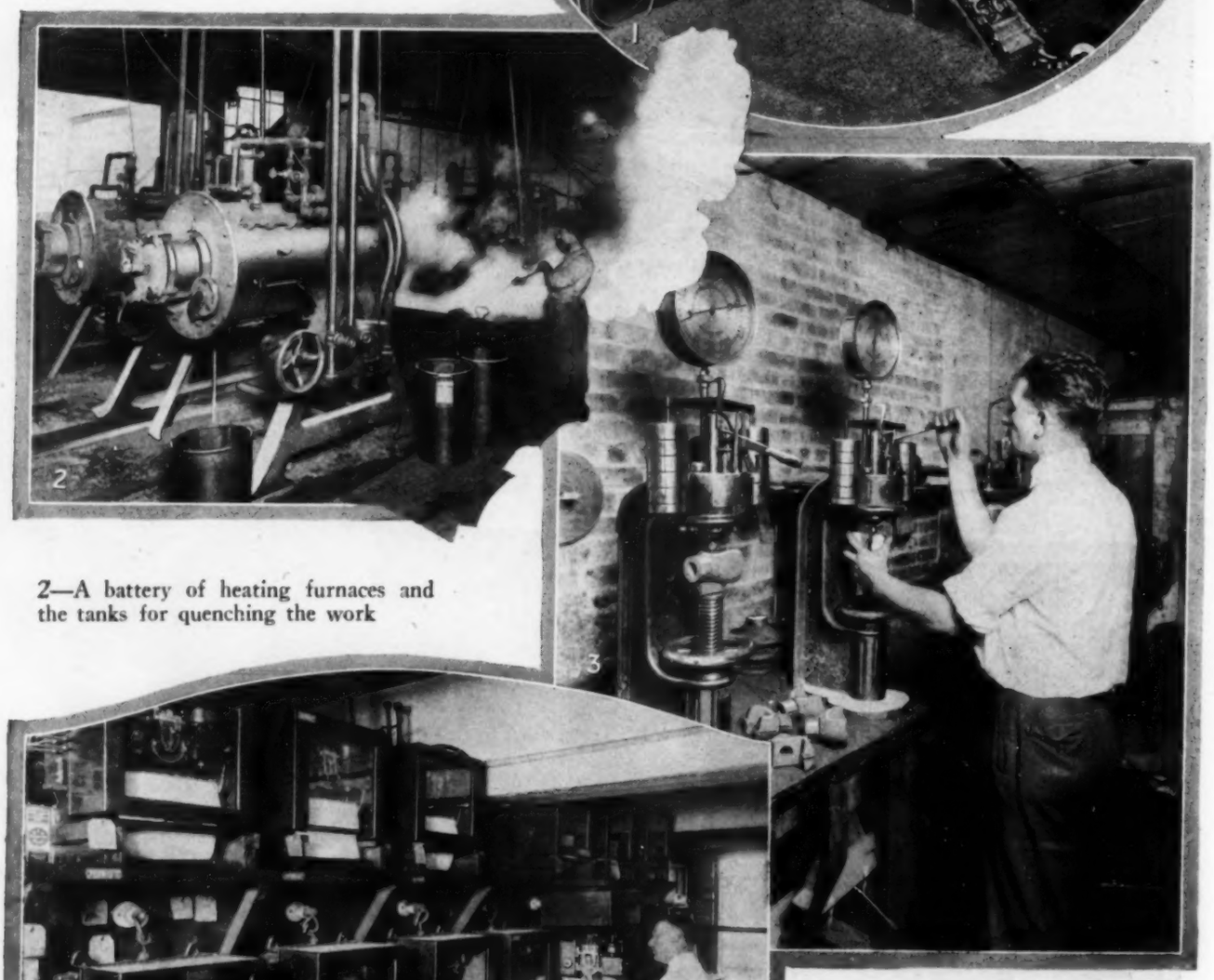


Photographs by Courtesy of the Air Reduction Sales Co.

Heat-Treating Universal Joints



1—Triple heating furnace that automatically regulates time of heat. Parts are automatically carried from one furnace to the next by self-feeding conveyors



2—A battery of heating furnaces and the tanks for quenching the work

3—The hardness of the yokes is shown by the Brinell test

4—Recording pyrometers register the temperature of each furnace

Photographs by courtesy of Spicer Manufacturing Corporation

Carburizing Piston Rods and Long Tubes

Methods that have been developed for handling large pieces commercially—Securing uniform work that must meet very severe specifications

SINCE nearly all carburizing practice deals with parts that are comparatively small, it is of special interest to secure definite information on work that is larger than usual. The methods to be described have been developed by the American Metal Treatment Co., Elizabeth, N. J., and include piston rods up to 48 in. in length, drill rods up to 22 ft. long and steel tubing for airplane work, up to 15 ft. in length. The equipment is that of the American Gas Furnace Co. and the methods follow:

For carburizing pump rods, rotary-retort machines, as illustrated in Fig. 1, are used. To prevent the possibility of distortion of the long rods and to insure the gas reaching all surfaces of the work, fixtures, termed by the operators "spiders" or jigs, are used. One of these "spiders" can be seen at *A*. It consists of a heat-resisting alloy made by mounting cast wheels consisting of spokes, rim and hub, on a tube. The wheels are spaced on the tube so as to prevent any sagging or warping of the material during heating. On the particular job illustrated, 30 rods make up a charge. The rods range from 1½ to 1¾ in. in diameter and up to 48 in. in length. Their average weight is 27 lb., making the total charge placed in the machine 810 lb. After the work has been placed in the retort, the cover is clamped in position and heating commences. At this time, a small amount of the gas used for carburizing is passed through the retort to expel the air so as to prevent scaling. The carburizing gas is then shut off until the work has been heated to the temperature at which carbon penetration will occur, about 1,400 deg. F., when the gas is again turned on.

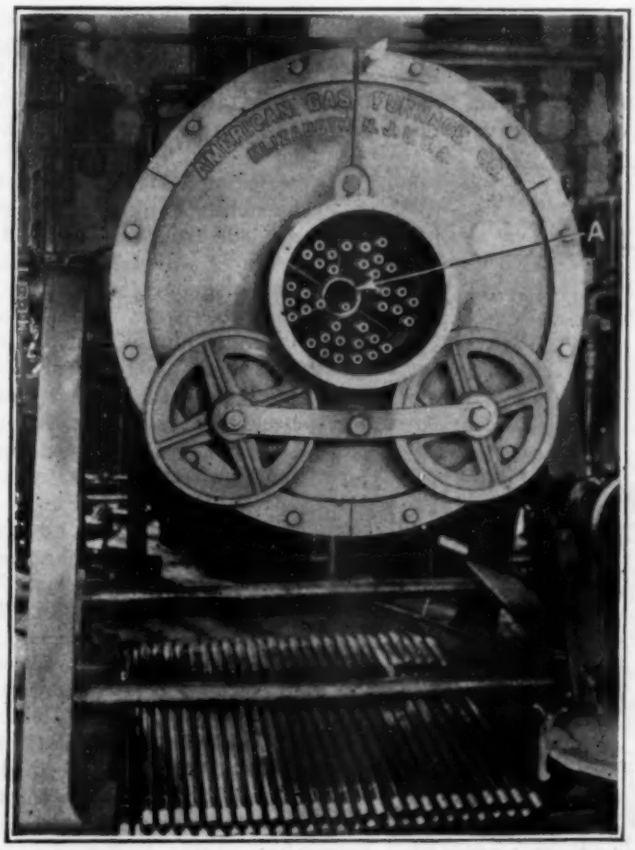


Fig. 1—Furnace arranged for piston rods

For this particular work, a case about $\frac{3}{32}$ in. deep and of 0.090 per cent carbon was desired. Consequently the work was brought up to 1,650 deg. F. and held for a period of three hours with the carburizing gas passing through the retort. Both fuel and carburizing gas were then shut off for a period of about one hour until the work had cooled to a temperature of 1,500 deg. F. This procedure allows the carbon in the case to penetrate deeper into the steel and the carbon concentration on the surface drops to about 0.90 per cent. At this temperature the rods are removed one at a time and quenched.

It has been found that quenching by horizontal submersion into the oil gives greater uniformity of hardness from end to end. Several horizontal brackets are located in the oil tank so that the shafts can be rolled backward and forward, thus securing as rapid and uniform quenching as may be desired.

Another class of work is done in the oven furnace illustrated in Fig. 2. This furnace has an available heating space 24 ft. long. A furnace with an available heating space 8 ft. deep was first used for annealing drill steel and work of that character. Such success was secured in annealing these lengths that arrangements for annealing longer lengths were proposed, when a second section was built onto the furnace, making the available heating space 16 ft. long. At a later date, a third section was added, increasing the length of the heating space to 24 feet.

To secure uniform heating over this length would, under ordinary cicumstances, be extremely difficult; however, with the system used with this furnace, no difficulty is experienced. Each 8-ft. section of furnace has three individual controls so that temperature can be varied from end to end, or the quantity of gas burned in each section can be varied to maintain a uniform temperature in spite of door losses, etc. An automatic heat controller of the Machlet type is used. The temperature throughout is maintained uniformly by simply adjusting the heat controllers to the desired temperature.

Large quantities of hexagon and round drill rod, from ¾ to 1¼ in. in diameter, have been annealed in this furnace, a temperature of 1,350 deg. F. generally being used. The second problem which required consideration after the uniform heating of the drill rods, was their uniform cooling. For this work, a cooling

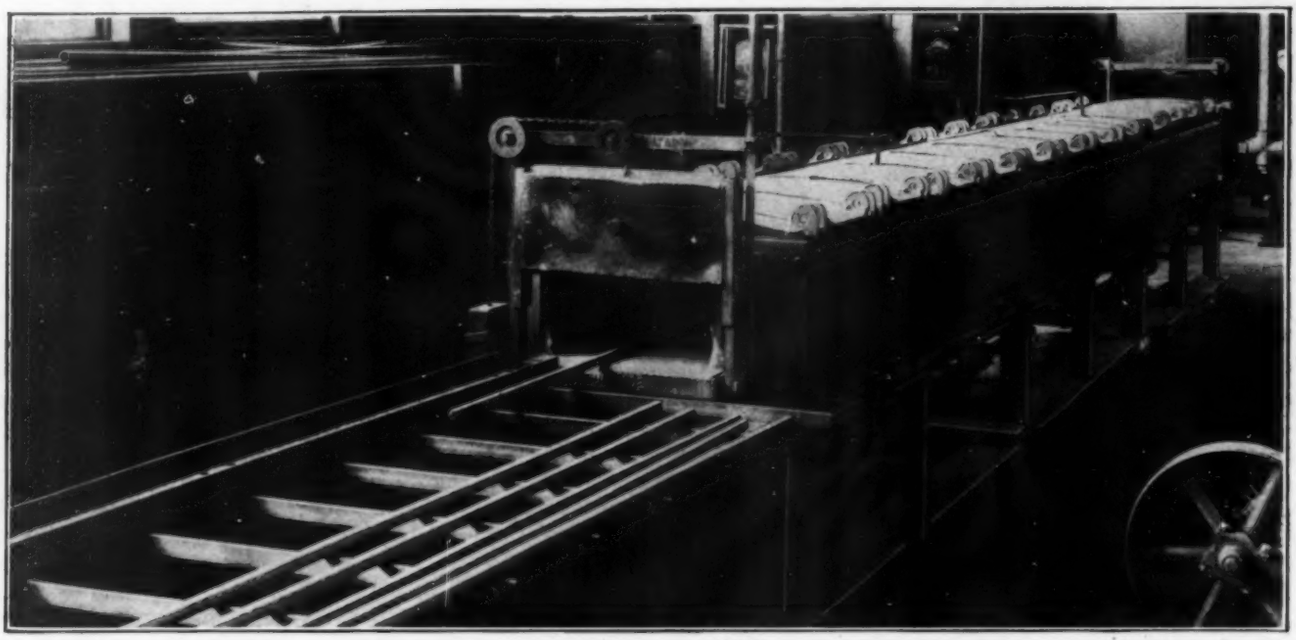


Fig. 2—Handling rods up to 22 ft. long.

bed as can be seen in the foreground of Fig. 2 was prepared. It is made of angles about 2 ft. long, spaced about 12 in. apart, and mounted on a frame so as to be level. The rods are drawn directly from the furnace on to the cooling bed where they can be turned over and

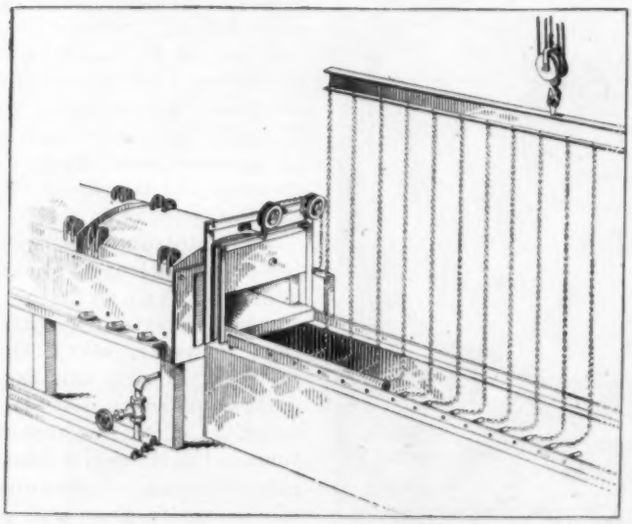


Fig. 3—A method of rotating tubes in cooling

tapped lightly as occasion may require, so that when cold they will be straight.

On still more exacting work, this furnace has also proved to be especially well suited. This work consisted in the hardening and tempering of the steel tubes used in the landing gear of airplanes for the U. S. Navy, and had to withstand very rigid tests before it would be accepted. Tubes ranging from 1 in. in diameter with a wall thickness of 0.035 in., up to 3¼ in. diameter and with a wall thickness of 0.250 in. and from 3 to 15 ft. in length, have been successfully hardened and tempered. The uniform heating secured in this furnace, using three temperature controls, made it possible to heat the tubes accurately to the desired temperature and to give proper conditions for the quenching, which was done when the tubes were withdrawn from the furnace.

In quenching, the tubes were drawn out, one at a time on to a rack as shown in Fig. 3, and then rolled on a modification of the parbuckle, consisting of a series of flexible chains extending from one edge of the quenching tank to a long beam which was supported by a tackle from the overhead girders. The chains formed a cradle which held the tube at many different points during quenching. By raising and lowering the beam, the tubes were rolled up and down in the flexible supporting chains, in this way securing uniformly quenched and comparatively straight tubes. After hardening, the temper was drawn in the same furnace used to heat them for hardening.

The tubes hardened, quenched and drawn by this method successfully met the severe specifications of the Navy as to hardness, tensile strength, elongation, bending stress, etc. Not one of the many thousands of tubes so hardened was rejected, in spite of the fact that the combined specifications of tensile strength, elongation and bending test was extremely hard to meet.

The bending test was especially severe. It required that the tube be held securely at one end and be supported on a fulcrum 10 in. from the secured end. Load was applied at a point near the opposite end of the tube. After half the load had been applied, the deflection of the tube at a point 20 in. from the secured end was measured with a dipping needle. Then the second half of the load was added, allowed to remain on the tube for a period of 5 sec. and removed. If the deflection had increased more than 0.06 in. the tube was rejected. After the tube had been tested for strength, elongation and bending, it was tested for straightness. The specifications required that in no part of any tube should the departure from straightness exceed one part in six hundred. This did not mean that a deflection of 0.01 in. be allowed if the tube were 60 in. long, but that a deflection of 0.01 in. was not permissible in any 6 in. over the length of the tube.

Effects of Oil- and Water-Quenching

By Frank C. Hudson

While heat-treating is a minor consideration in many plants, there are times when it becomes very important. An example is found in the shop of the Philadelphia Gear Works, where a small proportion of the work must be heat-treated to the extent of carburizing and hardening, or of hardening and refining, some of the alloy steels.

In most cases it is possible to follow the directions and suggestions sent out by the makers of the steel being used. Then, too, the handbook of the American Society for Steel Treating helps in some cases. But once in awhile a special problem comes up where the usual treatment does not entirely fill the bill.

Such a case is a shaft used in some of the gear-reducing mechanisms built by the company named above. To secure a surface hard enough to satisfy its desire for a long life bearing, it demands a hardness of 90 to 100 scleroscope. Experiments seem to show that it is very difficult to secure this degree of hardness by quenching in oil, but that water is necessary to cool the piece with sufficient rapidity to get the hard surface required. Further trials showed that by using a water quenching bath, the heating temperature could be reduced 50 deg. and still secure the hardness necessary.

On small shafts, however, the water quench has been found too severe, since the hardened shell is too great a percentage of the total cross-section, and does not leave a sufficient core to give the required strength. The same conditions exist in many pieces of small cross-section, and their treatment must be varied to suit both the requirements and the piece being treated. By remembering the different effects of oil and water on the work, steps can be taken to secure the desired results.

Aluminum Paint—Discussion

By E. Andrews
Manchester, England

Having had considerable experience with aluminum paint, I should like to add to the points brought out in an abstract on this subject, published on page 453, Vol. 64, of the *American Machinist*. Aluminum paints are now extensively used on account of their high reflectivity, heat insulation, corrosion resistivity, excellent hiding and covering power, and highly decorative properties. These paints show remarkable durability because the aluminum particles are not transparent.

Aluminum paints are easily made by mixing the finely powdered metal with spar varnish, shellac, lacquers, or linseed oil. Recent tests show that a boiled oil containing 25 to 30 per cent of aluminum powder, forms a better protective coating on structural steel work than does spar varnish containing the same proportion of aluminum powder.

A satisfactory paint can be made by stirring about 2¼ lb. of the fine metallic powder in 1 gal. of a mixture of two-thirds spar varnish and one-third boiled linseed oil, or a mixture of heavily boiled linseed oil thinned with mineral spirits and driers. Provided the aluminum paint is perfectly free from lead driers, its bright luster will not discolor on exposure to the air.

Long standing of the aluminum powder in the vehicle is apt to result in some deterioration of the paint, so that the best results are generally obtained by mixing the paint as required, and even then, it should be well stirred previous to its application.

In painting by means of a paint spray, care must be taken to protect products that are not to be painted, from the falling particles of aluminum, since the paint saturates the atmosphere and in consequence the adhesive particles have a natural tendency to cover all objects in the neighborhood of the paint spray.

Aluminum leaf has been greatly improved, and for lettering and ornamenting it gives very pleasing effects. The leaf in ribbon form can be applied by the use of a gilding wheel.

The Man in the Shop and Mathematics—Discussion

By Charles Kugler

The article by R. B. Willis, under the title given above, published on page 669, Vol. 64, of the *American Machinist*, interested me very much and I would like to say something further on the subject. I have found that the more a man knows about shop mathematics the more he will be inclined to use them, in spite of the fact that there are more simple and quicker methods of solving his problems in a direct practical way.

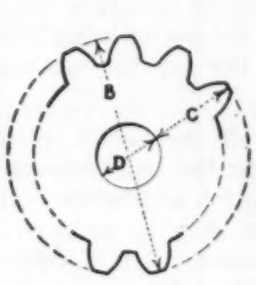


Fig. 1

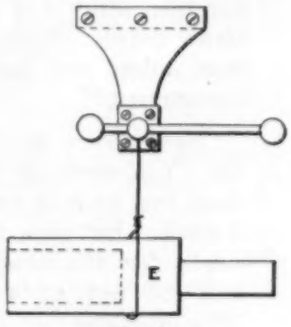


Fig. 2

Problems solved without trig

In Fig. 1 is an odd tooth gear in which it was desired to find the outside diameter *B*. When a certain shop foreman was given this problem he automatically got out his book to find the formula. Long before he was through figuring, the machinist measured distance *C* with a pair of calipers, multiplied it by two and added the diameter of the hole *D*, which gave him the diameter *B*, much to the surprise of the foreman.

An eyebolt was to be placed in the piece *E*, Fig. 2, so that it would be level when suspended from the crane hook. The problem was to find the center of gravity. Now this same foreman, who was a good mathematician, started figuring just where the center of gravity was located. The machinist tied one end of a piece of wire around the work and placed the other end around the screw of a bench vise, as shown. By shifting the wire and then turning the vise screw to raise the work from the floor, he soon found the proper place to drill and tap the hole for the eye bolt. This machinist finished the job long before the foreman was through with his calculations.

I know of one toolmaker who solves right-angle triangles with a bevel protractor, with a fair degree of accuracy.

THE · FOREMAN'S · ROUND · TABLE

Who Should Boss the Move Men?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

AL AND ED were on their way home once more and Ed was grouching over a new order that put all "move" men under one foreman instead of having an extra helper in each department.

"Why, doggone it, Al, they're taking all the joy out of being a foreman. Taking all our men away and making us into a lot of straw bosses. What's the use of being foreman unless you have the say in your own department?"

"Now you're going off the handle again, Ed. You seem to think the boss runs this place just to give you a job as foreman. He doesn't. He runs this shop to make dividends for the stockholders. If he didn't he'd be out of a job p.d.q.—or sooner. Whatever the old man does is because he believes it will save money for the firm. And he has a habit of being right most of the time."

"What's the difference whether you have all the move men in one bunch, or scattered in departments?" asked Ed.

"Not much, if it takes as many move men. But I'm guessing you'll find it will take fewer men than before. By putting them in one gang under a good foreman, they ought to cut out several men. He can route the men so as to save lost motion and be easier on the men, too. I'm inclined to believe it's a good plan."

"I don't see it, Al. I used to just say, 'Bill, take this work to department 27,' and it was out of my way. Now I've got to call up the new foreman on the inside phone and ask him will he please let Mr. Caruso stop at my place for a load of spindles. I don't like the feeling of it, Al. It ain't dignified."

"Well, dignity is all right in its place. But when dignity stands in the way of dividends, dignity gets side-tracked. You'll get used to phoning for a move man just as you do for castings or bar stock from the storeroom. And your department ought to make a better showing. Now you have a move man on your pay roll all the time. Under the new plan you'll only be charged with your proportion of the moving expense. And they may even put it all under a general heading.

"You'll find the move trucks will make a better showing, too. They can probably lay up one or two of them for spares or to take care of emergencies. It's a good deal like a small railroad. If every station agent kept his own locomotive to carry what cars he loaded, we'd have a nice mess. Now we'll have a foreman who will keep what trucks he needs moving most of the time. He'll either have regular schedules with extra trips where necessary, or he'll send trucks to pick up material in such bunches as he can, from the phone calls he gets. Give him a chance and see how it works out."

Is Al right about dividends being the main thing to keep in mind?

Is it possible to save labor by putting transportation under the direction of one man?

Is Ed's "dignity" really going to suffer under the new arrangement?

Is Al right about getting things moved faster with a separate transportation crew?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Where Shall We Start Apprentices?

FROM the standpoint of the apprentice I was particularly interested in this discussion since I am indentured to a large manufacturing concern making upwards of three hundred distinct tools. At this plant, when an apprentice is taken on probation he is allowed to choose between machining or erecting.

When I started as an apprentice there were about eight others in the class. Some picked the machine end first and some the erecting and fitting. I, in the minority, chose the latter and, I think, advantageously. Erecting gives the apprentice a chance to watch the assembly of a multitude of small parts of which he learns the names. This method familiarizes him with the general outlay of all types of one specific tool. It helps him form his concepts of the general proportions of machine members such as gears, bolts, pins, collars and shafts.

After serving two years on the erecting floor I went to the lathe section. The work methods seemed to flow to me in such natural sequence that I found no difficulty in getting the knack of lathe operation. On the other hand, the boys who went from machining to fitting were very slow to pick up the work because, I believe, they had no general experience to start off on. By all means start the boys on varied assembly work and I am confident that they will be better fitted to hold their jobs at the end of their indentures than if started directly in the machine shop.—R. PARKES, *Apprentice, Canada.*

Assigning Work to Machines

THE efficient planning, scheduling, and routing of materials and supplies from one operation to the next, has now become a necessity in these days of close competition.

Al's boss showed good judgment in calling in Al and talking over the different planning systems with him. The success of any system of planning depends entirely on how it is sold to the men that it is going to affect. Co-operation on the part of the foremen, therefore, is assured.

The envelope system is the better of the two mentioned, since the order, blue prints, instruction sheets, list of tools needed and requisitions for material may be placed in the envelopes by the planning department and in this way all the time that is usually lost for blueprints or tools can be saved.

The work should be routed against the different machines by the planning department since this relieves the foreman of a large amount of routine work and enables him to give more time to the supervision of the department and the improvement of methods.—THOMAS M. GARRY, *Foreman.*

Letting a Man Try His Own Way

A FOREMAN should never refer strongly to himself or to his methods at any time, especially when talking over or working out methods with the men. I believe a foreman's duty is not to get men to do as he says or to do the work as he says, but to work with the men in such a way as to get the best from each. A foreman could not get results if he did not have men to help him. Therefore his men and the organization should be very important in the foreman's mind.

He must let every man know in some way that everything the employee can say or do to help make production or working conditions better will be appreciated and needed by the company. There will be more discipline in the shop, according to my experience, when we work with the men instead of having them work for us. The company selected us to work with the organization to get production. At the same time the foremen are responsible for production and they must inform their men in the proper way that they expect efficiency.

I believe that, in Jimmie's case, if the foreman was big enough and broad enough in mind, he and Jimmie would be performing the work the best way they knew at that time. Neither one would be spending valuable time in discussing whose methods were being used. As far as sacrificing ideas to discipline is concerned it would entirely depend on conditions within the plant, of which the foreman would have to be the judge.—ALFRED BRIESE, *Superintendent.*

How Much Standby Equipment Is Necessary?

THE writer as a foreman deals with the milling of small quantities of parts of electrical equipment. The provision made for breakdowns is to have the fitter go over each machine with his wrench, screwdriver and oil can, replace any worn pins, screws or nuts while the machine is at rest and while changing over from one job to another. This reduces actual breakdowns to a minimum.

Our method for providing standby equipment is to have one machine of each type tooled up and ready so that when the operator has finished his job on a machine

THE · NEXT · TOPIC

Saving a Man's Face

QUESTIONS

Can sarcasm and ridicule be used in calling a man down?

When a grouch will cut a man's efficiency should the foreman overlook breaches of discipline?

Is the policy of "saving a man's face" by not "bawling him out" in front of his fellow workers a wise one?

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he merely changes over to the other machine. The toolsetter, fitter and operator are therefore kept busy and the machines kept up to requirements.

The handling of emergencies is easily cared for by this method of having one idle machine. I agree with Al that I should only revert to other machines as a last resort unless the work can be done more cheaply on a different machine.

If the new standby equipment is put to immediate use old equipment can in turn be tuned up and repaired when necessary. One point to be considered in any type of machine is the advantage of having all tools designed so that they are interchangeable.—C. L. HENRY, *Foreman, England.*

Picking Assistants

HOW often do we hear the foreman, in the absence of the "straw boss," say, "Let that wait till Mr. Whosit gets back." In maintaining understudies we are guided by their importance. A substitute sometimes develops greater worth than the regular foreman.

A man with experience may be found in our own ranks. Selecting a man with experience in the department is the better way. Records are sometimes as useful as detours. It is a good plan for the "straw boss" to go out occasionally and leave the foreman in charge. It might get Mr. Foreman familiar with the detail. —STORRS T. RICHMOND, *Master Mechanic.*

How Should Suggestions Be Handled?

BY SENDING Scotty to Williams, the superintendent, Al proves himself to be one who belongs to the class of really successful foremen, men who have faith in themselves and a belief that if someone else can run the shop better than they can, the sooner such a person gets on the job the better. Nevertheless men of Al's type seem to hold their positions and are difficult to shift. They are more difficult to equal.

The attitude of Ed stamps him as one lacking the broad outlook of Al. It also shows want of confidence in himself, bordering on jealousy. This is a most dangerous disease for any foreman to acquire and, unless smartly handled, will eventually ruin his career. No one is jealous of an inferior and Ed's action tends to make Scotty his superior.

The superintendent's action in not dealing with the men direct is to be commended, but qualifications are necessary. Times are changing and we must also change. Hard and fast laws are impossible and the superintendent who can be approached by everyone, and, at the same time, maintain in spirit the rule that everything concerning the foreman must come through him, is the ideal one. Such a superintendent calls in the foreman as soon as anything concerning him is broached by an employee. He thus places himself in the position of giving confidential advice to any employee in need.

The chances of finding himself supplanted by Scotty do not worry Al in the least but Scotty's chances of advancement are very much improved. Al will do all possible to help him along but Scotty must keep his head, remembering that one swallow does not make a summer. Although one smart piece of work may bring advancement, Scotty had better remain where he is if he thinks that one smart idea will keep him advancing.

I do not believe that Williams will introduce or encourage foremen's meetings. Temperaments vary and while some foremen get along with conferences, there are others that require very little of that sort of thing to start an ideal bear garden. A slight misunderstanding becomes a serious accusation and it is usually brought about by one who is a fine fellow in other ways and perhaps the hardest to replace.—F. P. TERRY, *Ireland.*

Just What Is Discipline?

OFFHAND, discipline is the enforcing of the rules governing the acts of individuals for the common good. The traffic policeman on the corner is a good example of the enforcement of discipline. Fundamentally no shop rule should be established that we do not intend to enforce. Any tendency to establish rules merely to protect an executive in case something goes amiss, with no intent to seriously enforce them, is a cowardly hypocrisy. Once established, a rule should be enforced. True, like the traffic policeman, the enforcer may overlook an occasional inadvertant transgressor, when he knows that it is just that, and not a habit. Like the traffic officer, however, he should never wink at any violation which seriously threatens the safety of others or of the violator himself.

To create the proper respect for rules, so that they require the minimum amount of "sleuthing" to enforce, it is absolutely essential that they apply to everyone alike, regardless of position. To err in this, is to break down our shop morale, and to invite the men to see how well they stand by what they can get away with.

Shop fooling or horseplay which may lead to serious injury must be stamped out as far as it is humanly possible. To begin, all reasonable safety devices, guards, etc., should be installed by the management to guard against all possible accidents in the line of duty. This registers good faith with the men on the accident prevention policy. With this as a start any violation should be immediately punished by a suspension or dismissal. To show that we mean business in this respect right from the start, is the best kind of accident prevention insurance. This, of course, does not mean that we should not exhibit some human qualities, and occasionally join in on a laugh which in no way can lead to any serious consequences or affect safety.— W. T. VAN HORN.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Changes in Size in Hardening Steel

BY C. U. SCOTT

During the hardening process a ½ or ⅝-in. tap made of carbon steel, will invariably increase in size unless great care is taken in cooling, while a ¼-in. tap will get smaller. The reason the small tap gets smaller and longer is due to the fact that it has such a proportionately great cooling surface and that the cooling takes place almost instantly. The larger tap requires more time in the hardening, and if taken from the cooling bath at the proper time, very little if any change will take place. This same rule applies in hardening larger pieces.

The lower the carbon the less drastic the change in cooling, and the greater the possibilities of making mechanical changes in the cooling. To make a piece larger, we must make a mechanical change that is entirely contrary to the physical change which the steel would have within itself. The point I am trying to make clear is that with machine steel, in carbonizing and hardening, we can make mechanical changes by utilizing the forces of the heat.

In order to do this, the natural changes that take place in the cooling of tool steel, must be controlled or changed in the cooling. As an example, take the ¼-in. tap or other small piece. If it is getting longer, use a less drastic cooling bath. If the ½ or ⅝ in. tap is getting larger, use less time in the cooling bath.

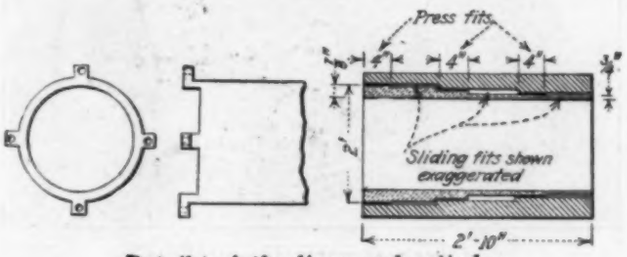
Brass Liner for an Air Pump

BY WALTER R. PARKINSON

The brass liner shown in the illustration was used to reline the air-pump cylinder for the condenser of a 1,000-hp. turbine.

The rough casting was approximately 3 ft. long, 2 ft. in diameter and 1 in. thick. It had four lugs at one end for attaching it to the faceplate of the lathe.

First, the casting was mounted in the lathe with lugs toward the tailstock. In this position it was held to the faceplate by long hookbolts. The body was then trued up and the lugs were faced. After drilling bolt holes in the lugs, the casting was bolted to the faceplate by the lugs. It was then bored and turned, the bore being given a final finish with abrasive cloth and oil. The abrasive cloth was fastened to a block of wood attached to the boring bar. The casting was then cut off near the lugs, leaving them attached to the faceplate.



Details of the liner and cylinder

Before inserting the liner, the cylinder was thoroughly cleaned and then coated with white lead and oil. Backed by heavy timbers placed against an engine foundation, the liner was forced into place by a screw jack, three men using a 5-ft. bar to turn the jack screw.

As the sketch shows, the cylinder and liner were each stepped so that the liner had to be forced for a distance of 12 in. only. The allowance for the press fit bothered me some, but I finally decided on one-half the allowance given for a shrink fit, as given in the *American Machinists' Handbook*. The job was done more than two years ago and has given no trouble whatsoever.

A Radius-Truing Device for the Grinding Wheel

BY HENRY DENSMORE

In the making of sectional dies and punches for motor laminations as conducted in the toolroom of the Westinghouse Electric & Manufacturing Co. at East Springfield, there are many parts of irregular shape to be ground. Since the same degree of accuracy must be preserved in the grinding of curved surfaces, corners, fillets, etc., as upon plane surfaces and angles, it is necessary to devise some means of dressing the grinding wheel to the required radii with equal exactness.

The illustrations shows one of the tools used for this purpose, and also the manner of setting it accurately. It consists of a steel block with a hole parallel to its longest dimension, having in the hole a closely fitted plug provided with an offset extension to carry the diamond tool.

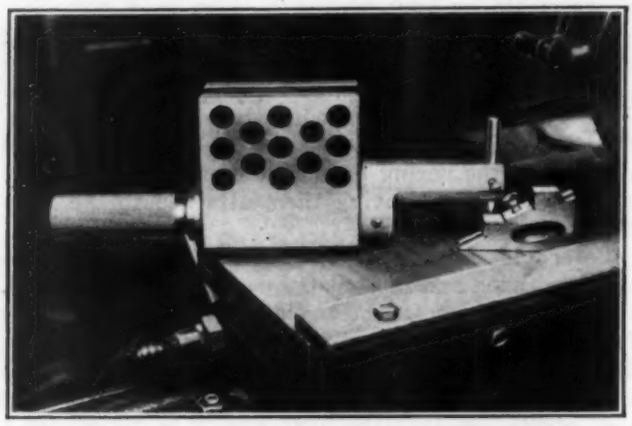
The making of this device is in itself a very fine job of toolmaking, since the block must be accurately square in three planes, and the hole, besides being round and parallel, must also be parallel with the outer surface of the block in two planes, and its center line must be a definite distance from one of the surfaces.

As shown in the illustration, the device is being set to true a curve on the face of the grinding wheel to a given radius. It will be noticed that the surface uppermost in the picture has a clearance in the middle so

that when the block is inverted—its usual position in use—it will rest only upon the two narrow bearings strips at the sides.

The opposite surface is similarly treated. The distance from the center line of the plug hole to the bearing surface at the top (in the picture) is immaterial, but the complementary distance is quite important, since it is involved in setting the diamond.

To make the setting, an adjustable height gage is first set to the radius required, plus the distance from the center line of the plug hole to the surface upon which the device rests, and the diamond is adjusted to bear upon the gage. Johansson blocks may be substituted for the height gage if desired, but the height gage



Tool to true radius on grinding wheel

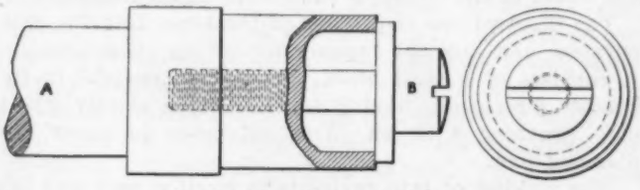
is convenient, and may be measured accurately with a micrometer to verify the setting.

To apply the diamond to the grinding wheel, the device is inverted so as to allow the diamond holder to swing clear of the surface upon which it is placed. The plug must turn freely in the hole, yet no looseness whatever can be tolerated in the fit. The large holes crosswise of the block are primarily for the purpose of lightening it, and at the same time they serve to provide an excellent finger grip.

A Self-Centering Test Button—Discussion

By Chas. Kugler

The article by J. A. Wheatcroft, under the title given above, and published on page 913, Vol. 64, of the *American Machinist*, interested me, but I do not see why it was necessary to make such an expensive device.



An inexpensive test button

For a number of years I have been using a device such as is shown in the illustration and have had good results.

The device consists of a piece of machine steel *A*, to which a ½-in. toolmakers' button is attached by the screw *B*. The tension of the screw should be such as will allow the button to move and to run true when it contacts with a soft object.

Strength of Taper Pins—Discussion

By Stephen J. Matosec

Permit me to call your attention to an erroneous statement in the article by H. B. Schell, under the title given above, and published on page 914, Vol. 64, of the *American Machinist*.

The statement referred to is as follows: "Since the pin is in double shear, the shear at one section will be considered half the total shear. The sections of shear in the pin are equidistant from the center of the pin, and since the taper is constant, *the mean area of shear is equal to the area at the midpoint of the pin.*" The italics are mine.

Since the areas vary with the square of the diameter, the italicized part of the statement is plainly an error. While the table, as published, is a nice piece of work and will do for the pins in question, I want to call attention to the danger of assuming its correctness when the pin tapers are more abrupt, or the diameters of the ends vary a great deal. In such a case the errors would be in proportion to the conditions.

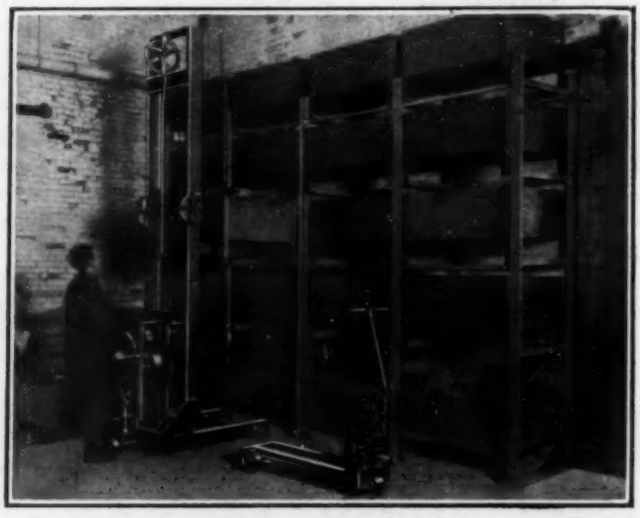
Portable Bins for Small Castings and Parts

By Milton Wright

The Lewis-Shepard Co. of Boston has devised a scheme for storing small castings and parts whereby is eliminated the necessity for counting out the number required to fill any given shop order. Instead of permanent bins and shelving in the stockroom, the parts are kept in portable bins made of heavy sheet steel, fabricated by welding. These bins are kept in suitable racks made of structural iron and built up in place by the same method.

When the factory gets an order for parts, instead of requisitioning the stockroom for a specified number, the foreman sends in an order for the parts by name without specifying how many he wants. The stockroom man merely takes down the bin and transports it to the lathe, drill-press, or other machine upon which the first operation is to be performed.

The machine operator takes the parts from the bin one by one as he needs them, and when his order is completed he calls for the stockman to take the bin away. In restoring the bin to its allotted place the experi-



A rack of portable stockbins

enced stockman can tell at a glance whether or not it is time for him to replenish his stock.

This method is made possible by the use of the portable elevator shown in the illustration. In this picture the man is just taking a full bin of castings from the rack, preparatory to taking it to the machine shop. When the bin is deposited on the floor the elevator is withdrawn and the jacklift truck, to be seen at the right, is run under it.

The dimensions of the bins are so calculated that the elevator platform passes under them widthwise and the jacklift truck passes under them lengthwise, obviating the necessity for turning the heavy bins around in a possibly cramped space.

Using Shapers on Production Work

By Frank C. Hudson

Shapers are not usually considered as production machines but there seem to be places where they can be used to advantage in handling regular work on a production schedule. It is largely a matter of providing the proper fixtures or holding devices to enable the work to be done accurately and quickly.

The illustrations show two shaper jobs that, although very different in size, are both done in the same vise or fixture, Figs. 1 and 2. The first is the sliding head that goes on the column and the other the base of a good sized machine. This fixture is designed to be used on a number of jobs and is arranged to handle various shapes by means of separate jaws or clamps as at *A* and *B*. The upper edges of both uprights have slots so that clamps of any shape that may be necessary, can be located in any desired position. Here again the front sliding support *C*, is part of the equipment. It can be adjusted vertically to suit the height of the table and can also be tipped a little to obtain a good bearing on the fixture.

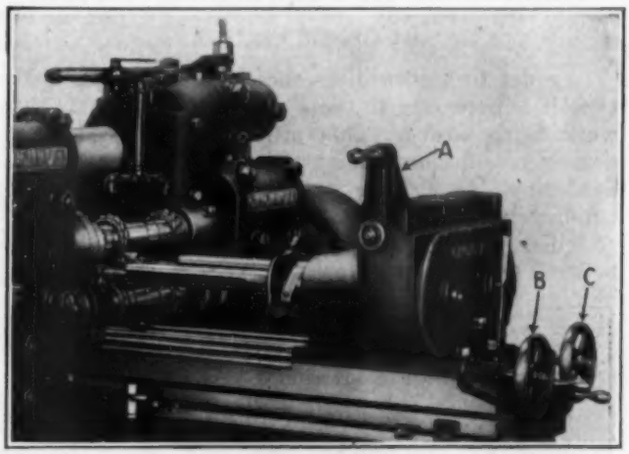
These are both from the shops of the Avey Drilling Machine Co., Covington, Ky.

Splining Transmission Shafts

By Charles Tuttle

As a general rule, transmission shafts are splined by hobbing, though in the Detroit plant of the Studebaker Corporation the work is done by milling, as shown in the illustration.

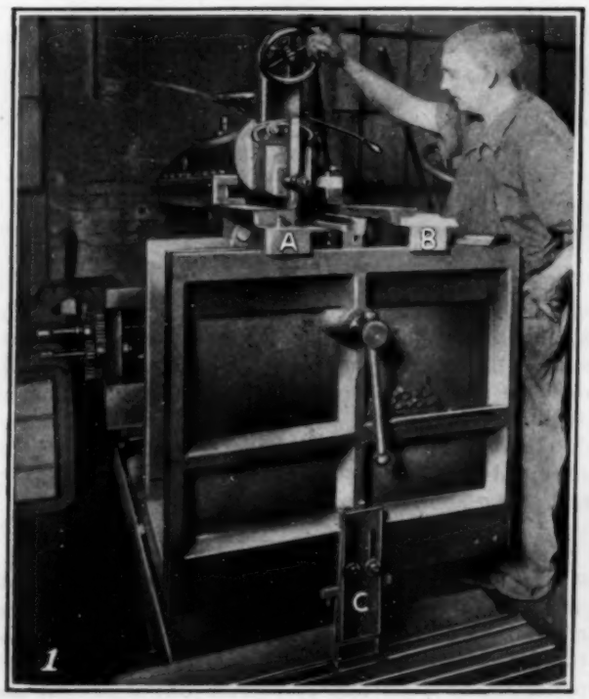
A special, two-spindle fixture carries two shafts between centers. Splines are cut on opposite sides of each shaft at the same time, four cutters being in service. The shafts are indexed 90 deg. for the remaining two splines, one revolution of the crank *A* completing the indexing.



Milling splines in transmission shafts

The tail centers are adjusted by the handwheels *B* and *C*. For convenience in loading, each center carries a small V-block in which the work can be supported while loading the fixture.

In moving to the cutting position the table travels at the rate of 150 in. per min., and when the cutting position is reached a dog automatically cuts the feed



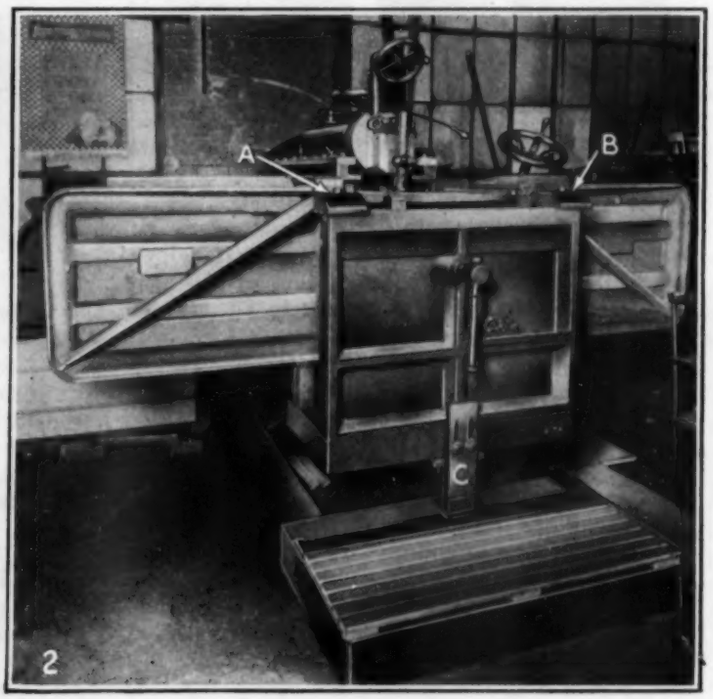


Fig. 1—Fixture for variety of work. Fig. 2—Another job in same fixture

down to a predetermined amount. After completion of the cut the table is automatically returned to the starting point at the fast rate noted above.

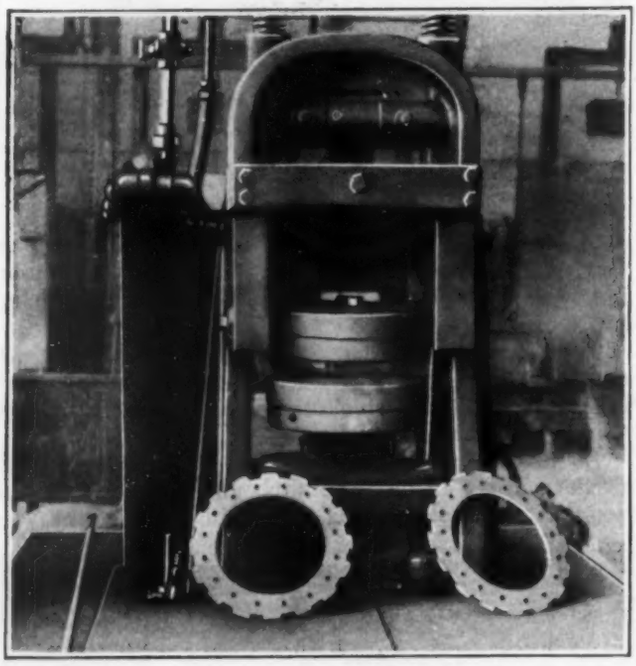
The cutters are form-relieved and have alternate chip-breaking grooves. The speed is 53 r.p.m. and the feed 3½ in. per min. The time per piece is 4.56 min. The work is done on a Cincinnati 48-in. duplex milling machine.

Home-Made Disk-Hardening Machine

By George Feltner

In order to harden disks successfully without distortion, it is necessary to use a device that will hold them while being cooled. This principle is utilized in the home-made machine shown in the illustration, for hardening clutch disks for the Harley-Davidson motorcycle.

A disk, after being heated to 1,400 deg. F., is placed between the upper and lower fixtures that are closed by



Hardening machine for disks

an air cylinder, holding the work firmly. Cold water is circulated through both fixtures, and, since the work is held between the cooled surfaces, hardening takes place. Ordinary water pressure, through 1¼-in. piping, is used. The disks are approximately 9 in. in diameter and ⅛ in. in thickness.

Annealing High-Speed Steel at Low Temperature

By C. U. Scott

Although the statement has been published before, I find that many mechanics are not familiar with the fact that high-speed steel can be annealed at a comparatively low temperature. Instead of heating it to 1,700 or 1,800 deg. F., it is only necessary to heat it to 1,292 to 1,325 deg. F., and to allow it to cool till black; then return it to the furnace and reheat it to the temperature given and hold it at that heat for 30 minutes.

How Would You Do This Job?—Discussion

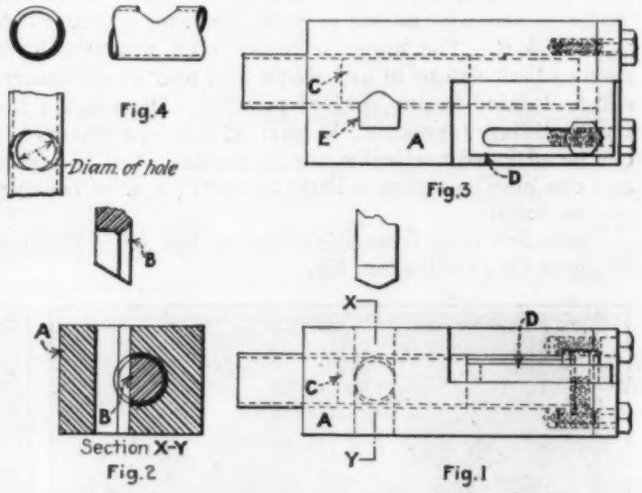
By C. O. Kowol

On page 869, Vol. 64, of the *American Machinist*, S. A. Robbins gives a solution for the problem presented by Henry Densmore on page 904, Vol. 63, to punch a hole in a steel tube or shell in which the diameter of the hole is to be nearly as large as the internal diameter of the shell. According to Mr. Robbins he would punch the hole from the inside and use a wedge-shaped plug with which to do the piercing.

I am of the opinion that it can be done very well from the outside, by using the punch and die illustrated in Figs. 1 to 3. This method would eliminate all hand work, as with Mr. Robbins device, which obviously means an increase in efficiency. In Fig. 4 is shown the kind of hole pierced in the shell, Fig. 1 is a front elevation, Fig. 2 a section through *X-Y*, and Fig. 3 is a plan view.

I should make the die in the form of a rectangular block having a reamed hole of the outside diameter of the shell. Then I should make a development of the hole to be pierced, make a templet of it for the openings *E* in the die *A* and in the plug *C*.

The opening *E* must be made with the plug *C* fastened to the die by two screws, and located by a dowel pin through its shank. The diameter of the plug *C*



Figs. 1 to 3—Tools for piercing the shell. Fig. 4—Shape of hole made in the shell

should be slightly smaller than the internal diameter of the shell, so the shell can be easily inserted. The cutout on the end of the die is for the stop *D*, which locates the shell endwise. Punch *B* is made as usual by fitting it to the die after the die has been hardened. It also can be easily ground, which obviously is another advantage in comparison with the punch described by Mr. Robbins.

In selecting cutting or cooling compounds for grinding-machine work, a number of factors should be considered. The compound should keep the work cool by rapidly conducting the heat away; it should tend to keep the wheel clean and free from oil; it should not rust the work nor injure the hands of the operator.

Methods of Hardness Testing

Rockwell Hardness Tests

The Rockwell hardness tester measures hardness by determining the depth of penetration under load of a steel ball or a diamond cone in the material being tested. The Rockwell test consists in applying a minor initial load to a standard penetrator, adding to this the major load, releasing the original minor load, and reading the amount of movement of the penetrator caused by the major load.

The minor load, which is 10 kg., clamps and seats the piece being tested and penetrates dirt and scale. The direct reading dial is set for zero penetration after the minor load is applied. Rockwell hardness readings are based on the depth to which the major load forces the penetrator. The greater this penetration the softer the material, so that the measurement of depth is the reverse of the degree of hardness. A reversed scale is therefore printed on the dial in order that the number can be read directly.

Rockwell hardness is expressed as a number which is equal to a constant minus the number of gage units of penetration under the major load. This method is used in order that high readings may be expressed by large numbers. Because of the direct reading on a gage the Rockwell tester is rapid for production work, and is claimed also to have the advantage that little damage is done to the piece. For a true hardness test the piece must be of such thickness that the under surface will not show a mark after testing. The minimum thickness of any specimen varies according to the hardness. The hardest steels give true hardness readings if over 0.027 in. in thickness. The true hardness of curved surfaces may be found if the radius of curvature at the point tested is $\frac{1}{16}$ in. If the radius is less than $\frac{1}{16}$ in. the tests are useful for comparison only.

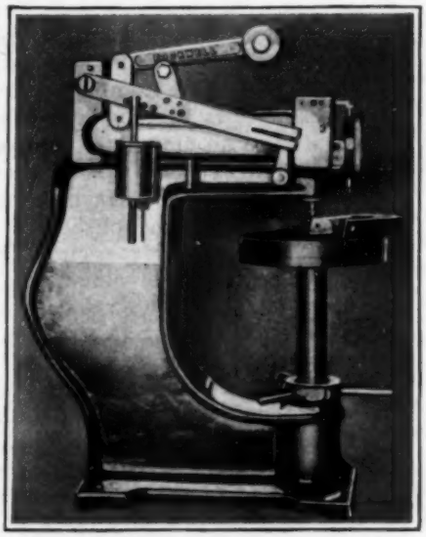


Fig. 1—The Rockwell hardness tester

A polished surface is unnecessary in testing with the Rockwell tester. On production work it is customary to remove the heavy scale, but for research work a surface similar to that obtained by rough grinding with a sandstone is usually prepared. The surface tested should not vary from the horizontal with reference to the vertical axis of the penetrator. Pieces with overhang should be supported securely so that there is no tendency to tip or give under the load. For holding cylindrical pieces an anvil with a V-notch should be used. The under surface of all test pieces must be free from scale or burrs that might flatten during the test.

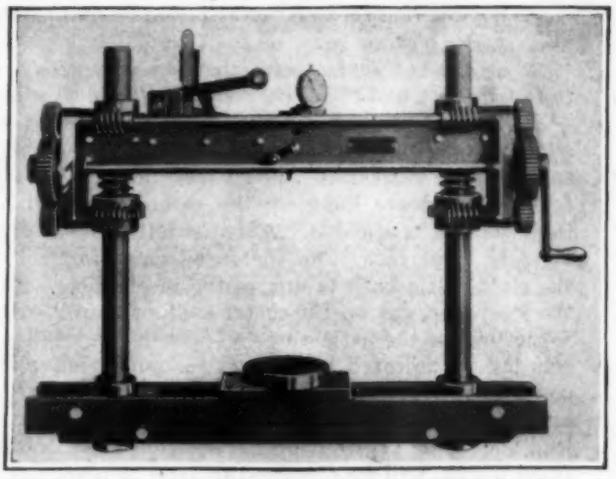


Fig. 2—A Rockwell tester designed for the testing of automobile cylinders in production

The Rockwell tester measures the hardness of the specimen at the point of penetration, but the reading is also influenced by the hardness of the material throughout a zone of about ten times the depth of the impression. In testing a case-hardened steel, therefore, where there is likely to be a softer layer of metal within the zone of influence of the penetrator, the impression will be deeper and the apparent hardness not so great.

The Rockwell scale is based on depth measurements, and the diamond cone is therefore more nearly accurate for hard metals. The steel ball is used in testing soft metals. Hard metals require the 150-kg. load and the diamond cone penetrator of 120-deg. angle. The point of the cone is ground to a true spherical shape.

Since two loads and two penetrators are used, two scales of hardness are placed on the dial of the machine. The black divisions and the letter C apply when the 120-deg. diamond cone penetrator and 150-kg. load are employed. The red divisions and letter B are used for the $\frac{1}{16}$-in. steel ball penetrator and the 100-kg. load. All data should be prefixed by the letter corresponding to the scale used. If the readings are below C-20 it is preferable to test the material with the $\frac{1}{16}$-in. steel ball and 100-kg. load and read on the B scale. Readings on the B scale are not usually taken higher than B-100, at which point it is customary to change to the C scale and use the diamond cone and 150-kg. load.

For the information given we are indebted to the A.S.S.T. and to the manufacturer

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Electrolytic Cleaning of Metals

Q. We are told that an "electrolytic" cleaning bath is used in the plating room of some automobile plants instead of the hot potash solution. Can you inform us as to the process, and the advantages of this method?

A. An electrolytic cleaning bath consists of a hot alkaline solution, usually with a high content of soda ash (sodium carbonate), in an iron tank. The articles to be cleaned are hung on the cathode bar, while the tank acts as the anode. A potential of from 6 to 12 volts is employed. The increased cleansing action of the electrolytic bath is due to the mechanical action of the hydrogen gas on the metal surface, and also to the formation on the article of free alkali. In addition the solution is agitated by the gases, and fresh alkali is constantly brought to the surface of the cathode, or article being cleaned. Articles containing tin, zinc, or lead should be kept out of the solution since enough of these metals will be dissolved to tend to plate the work that is afterwards suspended on the cathode bar.

Marketing Costs of Quality Articles

Q. I have recently had occasion to purchase some window fasteners of an ordinary pattern. I find that the retail price of these fasteners in brass-plated cast iron is 7c. each and in solid brass, 32c. each. These fasteners weigh less than 3 oz. each, so that the cost of material in the brass fastener is little more than in the iron. The cost of labor would seem to be more for making and plating the iron fastener. Why, then, should the brass fastener cost nearly five times as much as the iron one?

A. This question of apparent abnormal increase in price of quality articles compared with common commercial products is a combined production and marketing problem that is not generally understood by the buying public.

In the case of the brass-plated fasteners, these articles are staple, and there is little cost in moving them from the foundry to the user. The manufacturer can count on a steady demand, so he runs them as a continuous job. He is able to cheapen his methods and to use less skilled labor. Moreover, he can judge the demand so well that he does not need to maintain expensive stocks nor spend any money on marketing. Orders for standard articles of this kind are practically automatic.

On the other hand the solid brass "quality" fastener is an indefinite affair. The hardware dealer may keep a stock on hand for a year without moving one piece. The money tied up cannot be computed with simply a normal interest loss, since the dealer's capital should be turned over at least three times a year. The dealer, moreover, has to put more sales effort into a sale of "quality" goods.

The manufacturer of the "quality" article cannot count on the demand, and when he receives small orders at irregular intervals he has to set up and organize the production work as a new thing. He also will be required to be more particular on inspection, and his spoilage will be greater. If he keeps a stock to meet the small orders, he will be losing money on his capital tie-up. He also generally has more correspondence and personal sales effort attached to placing an order of "quality" articles.

Studying the capital, labor, sales, and other costs in detail it can be seen that the accumulated cost of the "quality" article to the retail purchaser will be in something like geometric progression as compared with the common commercial article that the public naturally accepts. It is not surprising, therefore, that a quality article such as you mention will cost five times more than a staple article.

Aluminum Paint for Shops

Q. I have recently seen a shop interior completely painted with aluminum paint, and am told that it is an effective aid to lighting. Can you inform me as to this point, and also as to its relative cost and durability?

A. The use of aluminum paint for industrial plants is new, but is rapidly increasing. Aluminum paint is made from an aluminum powder mixed with linseed oil or some other base. The powder is manufactured from aluminum leaf, and can be obtained either polished or unpolished. When polished powder is used the paint has a brilliant surface with high reflecting power.

The color of the aluminum paint used for factory interiors is silvery gray, and gives the room a clean appearance. About 70 per cent of the light is reflected from the paint, and is diffused in such a manner as to be agreeable to the workmen's eyes.

Another advantage of aluminum paint for shop use is that it is an effective radiator of heat. A coat applied to the underside of a tent is claimed to shut out 85 per cent of the sun's heat rays. When it is considered that the ordinary black roof absorbs about 90 per cent of the sun's rays and re-radiates the heat from the under side, the value of an aluminum paint coat on the factory ceiling is seen. It is particularly valuable in this respect for the one-story modern steel-frame shop with steel trusses and steel or composition roof. An aluminum paint on the walls and ceiling of the shop then acts as both a lighting aid and an effective protection against excessive summer temperatures.

Aluminum paint is claimed to have great covering capacity and to be very durable. A gallon of the paint will cover about 750 sq.ft. of surface. It is also claimed that one coat is sufficient for the interior painting of factory rooms. Aluminum paint is now also used for outside painting of water towers and oil storage tanks. The paint serves the double purpose of protecting against corrosion and of keeping the temperature low under exposure to the sun.

Technical Abstracts

Gear Transmission for Diesel Locomotives

The first locomotive to be equipped with a gear transmission system in which the speed changes are controlled by high powered magnetic clutches was recently finished for the Russian railways by the Hohenzollern Locomotive Works, Düsseldorf, and the Magnet-Werk, Eisenach. The locomotive is a Diesel electric with a 1,200-b.hp. Diesel engine. The weight of the locomotive in working order is 275,000 lb., and the highest tractive force is 42,000 lb. at 4 m.p.h. The locomotive is provided with Westinghouse brakes.

The main magnetic clutch is keyed to the backward extension of the crankshaft, and the power is transmitted by this clutch to the gear box, which contains a set of gears and three magnetic clutches for three different speeds. The main magnetic clutch is made of special soft steel and is of sufficient weight to act as a flywheel for the Diesel engine. The gears in the gear box are always in mesh, and the changing of speed is accomplished merely by engaging and disengaging the clutches. The total weight of gears, clutches and housing is 30,800 pounds.—B. A. Wittkuhns and N. Foder, in *Railway Age*, July 24, 1926, p. 139.

Wrought Iron Pipes Still Available

When gas was introduced wrought iron tubes were employed. Later when the production of steel was increased and the price reduced wrought iron became dearer than steel, and the latter began to be used generally for tube making. For many purposes the greater strength and ductility of steel are essential, but for gas service pipes corrosion has always been troublesome, and soon after the introduction of steel it was shown that it was less resistant to corrosion than was wrought iron.

Alarm has been caused by statements that little or no wrought iron is now made into tubes, steel being used exclusively. There is no foundation for this statement, and users may have complete assurance that they will obtain genuine puddled iron tubes if they order from a reputable firm.—*The Gas Engineer*, London, August, 1926, p. 154.

Less Circus and More Common Sense in Management

Good business management is seldom sensational. The need for miracles indicates that something has been wrong with the business. All the activities of a business must be kept abreast and no man who is a specialist or technician can be depended upon not to favor his pet department. It may be harder work but it is better business to keep things running so well that it is never necessary to pull them up with a jerk. Careful budgeting of every feature of a business is vital to the success of this type of management. The right type of man for executive work is hard to find and hard to train. The average college engineering graduate is overdeveloped on the technical side. Personal contacts by the major executives are invaluable aids in securing business and in saving orders that might otherwise be lost. Business so secured is likely to exceed in volume the business brought in by the sales department. The absence of circus methods makes for steady growth, low overhead and satisfactory profits.—Charles Piez in *System*, September, 1926, p. 273.

Increased Size of Units of Production

The use of materials handling machinery in manufacturing plants is becoming so general that it is now considered an important part of any manufacturing program. It is just as important as a drill press or any other production machine. Increasing the size of the unit of production reduces manufacturing costs. It facilitates the handling of materials and increases the production of machines and of men, but materials handling machinery alone makes this increase in the size of the unit of production possible in the modern shop.

Only four years ago the largest bundle of wire used in any wire mill weighed 150 lb., and was limited to the size of the coil a man could lift by hand. Today there is not a large wire mill that has a unit of production less than 300 lb., and many have units of more than that figure.

Bolt, forging, and stamping manufacturers used to handle their product from one machine to another and from one department to another in 50-lb. tote boxes, but the progressive plants have now installed materials handling machinery that permits the material to be moved about in much larger units. The foundries, also, are increasing the size of the ladle from which the molten metal is poured, as well as increasing the size of the flasks and patterns with the result that a greater number of castings are produced from each mold.

The application of materials handling machinery has made the size of the unit of production practically unlimited. Some users of materials handling machinery, however, use this machinery on small units of production without realizing the proverbial gold mine that is in store for them if they increase the size of the unit of production.—E. T. Bennington, in *Industrial Management*, August, 1926, p. 115.

How Electric Traveling Cranes Came

The first electric traveling crane was built about 1881 at the plant of the Morgan Engineering Co., Alliance, Ohio. Its single motor operated the longitudinal drive through a main drive shaft and clutches.

In 1890 the first three-motor crane was put in operation. It was built by the Pawling & Harnischfeger Co., Milwaukee, and designed by an engineer named Shaw, who later organized the Shaw Electric Crane Co.

One of the early cranes of the square-shaft type was erected in the Watervliet arsenal. The 420-ft. shaft was made in 30-ft. sections welded together on the job.

The Homestead Works of the Carnegie Steel Co. was the first big plant that went definitely to the use of electric cranes, purchasing thirteen 10-ton cranes in 1893.

One of the important developments has been the double-bridge drive for open-hearth ladle cranes with the drive on all four wheels.

There has been a continual tendency toward cranes of larger capacity and higher speeds. Cranes now have hoisting speeds of 15 to 200 ft. per minute with bridge travel of 200 to 600 ft. per minute while carrying loads of 20 to 225 tons.

Each of three cranes erected by the Alliance Machine Co. in the Washington Navy Yard has a combined handling capacity of 430 gross tons.

The Homestead Works of the Carnegie Steel Co. has ordered from the Alliance Machine Co. a 275-ton crane for changing mills. The mill complete will be lifted from its place and another substituted, instead of changing rolls.

The adoption of the worm drive will be an outstanding feature in the crane of the future, because the mechanism is more compact, there is greater accessibility to parts, and there are fewer parts to look after.

The future crane will have roller or ball bearings. It will be larger. Costs in steel plant operations probably will be lowered by using cranes larger than at present.—W. H. Purcell, in *Iron Age*, Aug. 26, 1926, p. 541.

Danger in Old Boiler Installations

Official statistics show that ten steam boilers exploded during the year 1925 in Germany, killing 17 persons and injuring 22 others. The fact was brought out that these explosions invariably occurred in old installations. Six of the boilers had been erected previous to the year 1899, and one had been built in 1890. The two most recent installations had been in service for 14 years. No explosions occurred in new installations.—*V. D. I.*, Berlin, July 17, p. 984.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Efforts to Eliminate Waste

MANAGEMENT week is becoming a national institution. Beginning in 1922 with a small group of nationally known engineers and technical societies it has grown steadily year by year until, in 1925, there were 115 meetings held in various parts of the country. The real object of these meetings is to stimulate thought and action in the movement toward the elimination of waste. For waste, in the long run, helps no one and adds to the expenses of living and of doing business.

It will be remembered that the Hoover Committee, back in 1921, attributed half the waste they found to faulty management. Under this stimulus managers have been giving more and more attention to modern methods and many improvements have resulted. But we are still far from perfect.

The metal working industries can be proud of the showing made in the Hoover investigation, they being credited with but 29 per cent waste while the nearest competition was the boot and shoe industry with 41 per cent. The greatest waste was in men's clothing at 64 per cent.

With even 29 per cent waste there is still plenty of room for improvement and the metal industries will play their part in the movement that is to be staged during the week of October 25-30th. The work will, for the most part, be directed by the various national technical societies in whose activities management has a part.

An American Responsibility

EVIDENCE is multiplying that European industrialists are truly interested in applying American methods of manufacturing, distributing and making money. The traditions that have handicapped the employers and the workmen in the old countries for so many generations are apparently about to yield to economic necessity.

The modernization of European manufacturing methods will be viewed with mixed feelings by American industrialists and merchants but the general consensus will undoubtedly be that anything making for less economic waste will be for the good of the whole economic fabric of the world.

Changes so drastic as those in prospect spell opportunity for many Americans but they mean responsibility as well. Steps must be taken to prevent Europeans who are truly eager to get the best thought of American industry from being victimized by willing advisers whose knowledge is based more on theory and conjecture than on practical experience. Americans have had plenty of sad experience with men of this type. A few years ago they masqueraded as efficiency engineers so effectively that they earned a very evil repute for the efficiency engineer in general and more than offset the good work done by the few real efficiency experts. It is to be hoped that they will not be permitted to seize this opportunity to gull innocent clients and by so doing to add one more to the score of misunderstandings that are still doing their part to keep Europe and America apart.

What has been said should not be interpreted as an indictment of all those who call themselves industrial or consulting engineers, for the real engineers can do Europe an infinite amount of good. The responsibility on the Western side of the Atlantic is to keep the charlatans out of the picture and give the reliable engineers their chance to assist European industry to the extent of their powers.

Anti-Friction Bearings for Railway Cars Are Gaining Favor

THERE is good reason to believe that the general application of anti-friction bearings to railway car journals is not far off. Experiments extending over more than four years have shown that a properly designed bearing of this type will stand the shocks of rail service and at the same time considerably reduce rolling resistance and maintenance costs. As a result of the experiments several railroads are getting figures on the cost of equipping new cars with anti-friction journal bearings and at least one road has placed substantial orders.

General introduction of anti-friction bearings will naturally involve a decided change in bearing inspection and repair practice. Education of both shop and terminal crews will be necessary because the success of the new type of bearing depends on the way it is treated. Revision of overhauling schedules must take place by reason of the considerably longer service to be expected from the anti-friction bearing.

From the equipment standpoint it will be necessary to provide for better finishing of axle journals and bearing boxes to take care of the higher standards of accuracy incident to the use of anti-friction bearings. There should be a particularly good opportunity for grinding machine and grinding wheel business. Manufacturers of grinding equipment will watch this development with more than ordinary interest.

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Whipp Open-Side Planer-Shaper Improved, 26- and 36-In.

The Whipp Machine Tool Co., Sidney, Ohio, is marketing the improved, open-side planer illustrated in Figs. 1 and 2. The table is oscillated by means of the usual slotted-crank mechanism employed for shapers. Hence, reversal of motion takes place within the machine, and a single-direction pulley or motor is used to drive.

The base of the machine is a box section strengthened with cross ties from wall to wall. A corner brace has been added between the pad for the column and the adjacent side. The column is a hollow tube and is also internally ribbed to resist the torsion to which the column is subjected by the tool loads on the cross rail. The column wall is an inch thick. The column is held in position with respect to the base by means of a large key and six 1-in. bolts, in order to maintain its alignment.

The cross rail is also a box section and is heavy and stiff. It is clamped rigidly to the column. The saddle and its parts are also said to be as proportionately heavy as other parts of the machine.

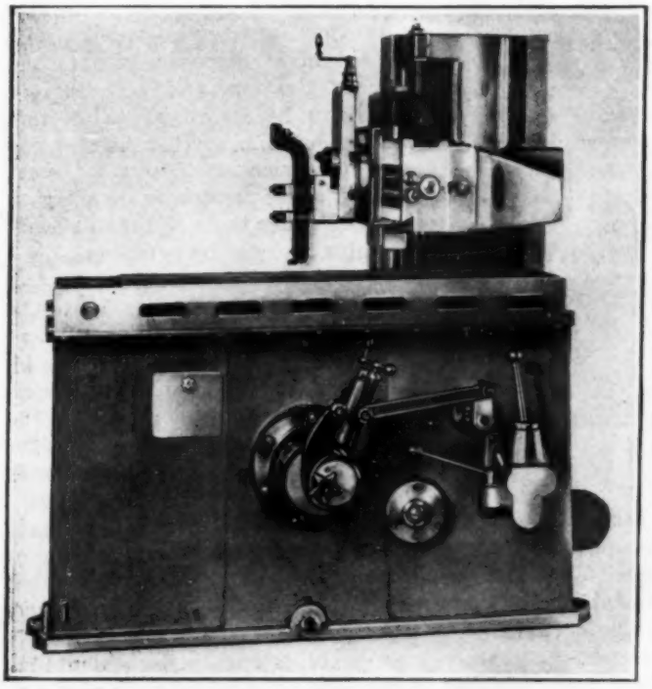
The bull gear carrying the crank consists of a steel forging, shrunk on and pinned to a semi-steel center. The teeth are of helical form and of coarse pitch to give the necessary strength. The bull gear weighs 480 lb. The speed change gears are all steel and are mounted in a separate gear box. The gears are completely inclosed and run in a bath of oil. Lubrication to the bull gear bearings, the pinion bearings, and the table guides is provided for by means of a forced-feed automatic lubricator.

The machine is controlled by means of a dry-plate clutch that incorporates a brake, which is automatically applied when the clutch is released. It is said that the combination is powerful enough to start and stop the machine in the middle of the heaviest cut that it can take. The clutch and brake lever is located in the same unit with the gear-shift lever, convenient to the operator. The control for the saddle feed is also placed near these controls. The saddle feed is adjustable while the machine is running.

The drive of the machine is either by means of a single pulley or by motor. The motor is mounted on a bracket on the table and drives by means of a silent chain properly guarded. The motor runs at 1,150 r.p.m. and 7½ hp. is recommended for the 26-in. planer and 10 hp. for the 36-in. planer. A pulley 16 in. in diam. and 4 in. wide is supplied for both the 26- and 36-in. machine. The recommended speeds for the pulley are 300 and 250 r.p.m. respectively.

The table travel is 26½ and 36½ in., respectively, for each machine. In both cases the maximum height accommodated under the cross rail is 18 in. The total down feed is 9 in., while the total cross feed is 25 in. The maximum horizontal feed is ⅜ in., while the maximum vertical feed is ¼ in. in both cases.

The height of the table from the



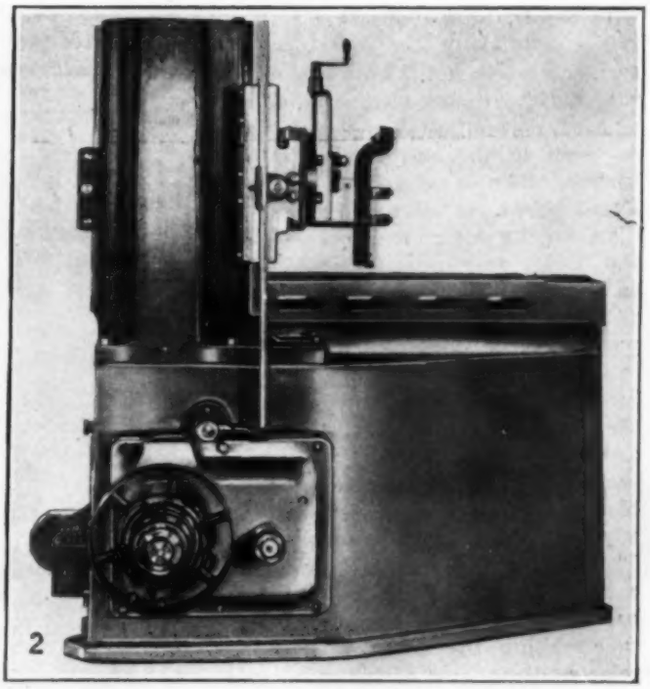


Fig. 1—Whipp Open-Side Planer-Shaper, Improved, 26- and 36-In. Fig. 2—Rear view of the machine

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floor is 36 in. for the 26-in. machine, and 43½ in. for the 36-in. machine. Strokes ranging from 7 to 54 per min. in the case of the smaller machine and from 5½ to 43 per min. in case of the larger machine are provided. The net weights are respectively 6,600 and 7,200 pounds.

O. K. Cutters and Tools

The O. K. Tool Co., Shelton, Conn., has added to its line of cutting tools several improved types, as shown in the accompanying illustrations. The bodies of the milling cutters and boring tools are made of heat-treated, chrome-nickel steel and the blades are of high-speed steel in each case. The blades are driven tightly in serrated, tapered slots in the bodies.

The serrations on the backs of the blades are parallel with the axis of the cutters. The disposition of the

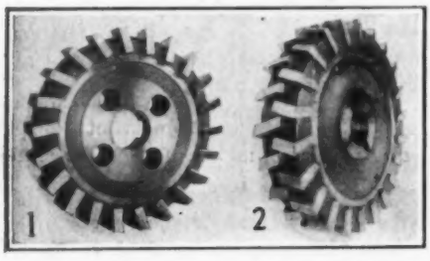

Fig. 1—Heavy-Duty Face Mill
Fig. 2—Interlocking Slotting Cutter

serrations in the respective slots of the cutter bodies is in accordance with the O. K. system; that is, the radial distance of the serrations in each successive slot is advanced from the cutter center by a definite amount, depending upon the number of teeth in the cutter. With this system, when a cutter has been reduced below its allowable limit in diameter by wear and regrinding, the blades may be driven out and each blade returned to the slot one number in advance of its previous position. By this adjustment the overall diameter of the cutter will have been increased by an amount that is sufficient to allow it to be reground to its original size.

The serrations on the backs of the blades are alike in relation to the edge, and the blades are not marked. The slots in the body are numbered consecutively from zero to the number of blades in the cutter, to facilitate making the adjustment. The relative disposition of the serrations in the slots is such that when this readjustment has been repeated a number of times equal to the number of blades in the cutter, each blade will occupy its original slot, but will have been advanced radially by the width, or pitch, of one serration.

In several of the cutters that are made in a range of sizes, it is practicable to use the blades of one cutter in the body of a cutter of smaller size when the range of adjustment of the first cutter has been exhausted. In this way, a maximum amount of wear of each blade is obtained.

In Fig. 1 is shown a heavy-duty face mill, intended for use in connection with a shanked driving plate, to which it is attached by means of fillister-head screws. It is made in sizes ranging from 8 to 24 in. in diameter. The screw holes in the cutter body are jig drilled, so that one driving plate may serve for several sizes of cutter.

A double-faced slotting cutter with interlocking teeth is shown in Fig. 2. The body of this cutter is made in two parts, fastened together by fillister-head screws. The two parts may be separated and packed apart by placing space washers of paper or

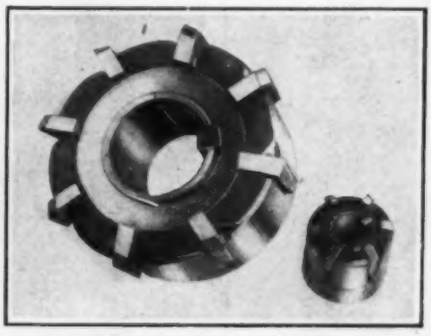

Fig. 3—Boring Head, 3-in. and larger

thin sheet metal between them, in order to restore the overall thickness to its original dimension after it has been reduced to the allowable limit by wear and regrinding. This cutter is also made in sizes ranging from 8 to 24 in. in diameter, and its blades are interchangeable with those of other types and sizes.

A boring head intended for use on the arbor of a horizontal boring mill is shown in Fig. 3. This tool is made in sizes ranging from 3 in. up to any diameter specified, and it possesses the same feature of adjustability to restore its size when necessary. It is provided with a tapered, split bushing and a threaded collar by which it is made to grip the arbor tightly after it has been positioned thereon. A substantial

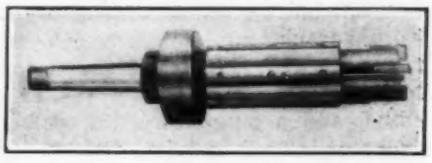

Fig. 4—Jig Boring-Tool

square-sectioned key takes the strain of driving it. Fig. 3 shows two sizes of the boring head.

A form of boring tool intended to be used in the spindle of a boring mill, milling machine or drill-press is shown in Fig. 4. It is provided with either a parallel or a tapered shank as specified. This tool is designed for use in connection with a jig and is provided with an adjustable stop-collar and with hardened steel wearing strips to bear in the jig bushing. These strips, six or more in number according to the size of the tool, are set in parallel slots equidistantly disposed about the body of the tool and held therein by fillister head screws. When this pilot, or bearing portion, has become worn in service the strips may be set out by placing paper or other packing material under them and the original diameter restored by grinding.

The stop-collar consists of two hardened steel rings, threaded to the body of the tool and capable of being tightened in any relative position by screwing them forcibly together, after the manner of lock-nuts. The periphery of each ring is slotted for a spanner, which is furnished with the tool.

One of the cutter blades is made wide enough to cut to the center of rotation; the others are somewhat shorter. Because of this construction, the tool is not susceptible to the same minute enlargements to compensate for wear as in the case of the other cutters. Adjustment may be made by advancing each

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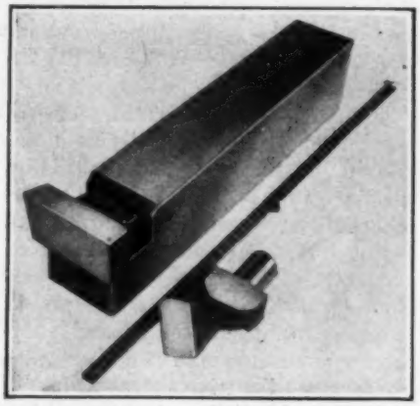


Fig. 5—Heavy-Duty Planer Tool

blade a distance equal to the pitch of the serrations and by substituting a new wide blade. Blades ground down to the limit in one size may be used in the body of the next smaller size. This tool is made to order in any commercial size from 1¼ in. up.

A heavy-duty planer tool of the O. K. type is shown in Fig. 5. The body of the tool is made of heat-treated, chrome-nickel steel and the bits of high-speed steel. The body of the tool measures 3¼ x 4 in. in section and is 18 in. long. The tool-bits have round shanks, 1¼ in. in diameter, by which they are held in the body and returned therein by the pressure of a sliding bar, which bears behind the shoulder of the bit and is tightened by a setscrew in the end of the body. Square-nosed bits, as shown in place, and right- and left-hand diamond-point bits, one of which is shown beside the tool, are furnished.

Bausch & Lomb Metallographic Equipment Model GB-ILSAA

The Bausch & Lomb Optical Co., Rochester, N. Y., is marketing the improved metallographic equipment, model GB-ILSAA, illustrated in the accompanying photograph. This unit is designed particularly for the use of metallurgists and engineers, and it has been built in conformity with the requirements of the American Society of Steel Treaters and of the American Society for Testing Materials.

The complete Metalloscope consists of an inverted microscope and illuminating system mounted upon a permanently-aligned unit, a camera and camera support, a shock absorbing system, and a stand for supporting the unit. The optical parts of the microscope and illuminating system are accurately centered and aligned and permanently mounted in the proper relative positions.

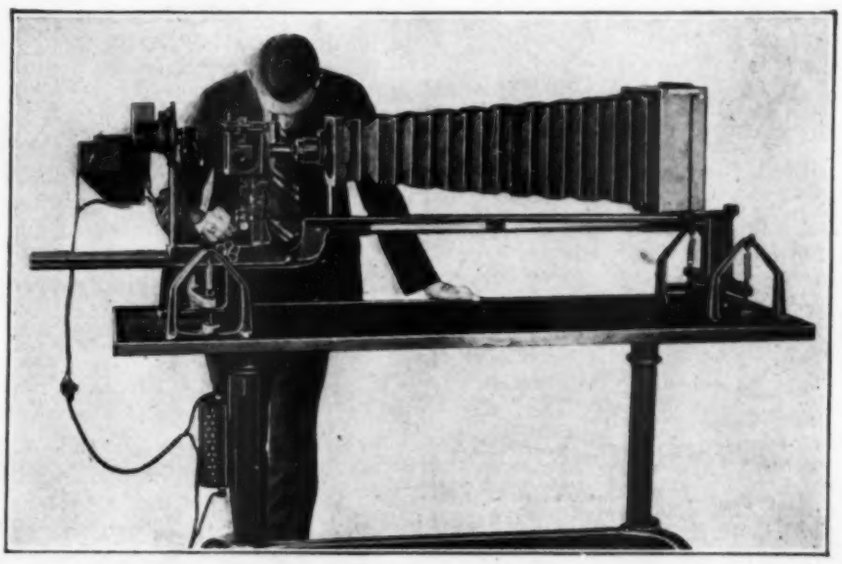
The improved stage, which is above the microscope tube, carries the object with its flat surface downward. This stage is supported at both corners by a unit casting, which is in turn supported at its center This construction is said to assure permanent parallelism between the plane of the specimen and the focal plane of the microscope, regardless of the size or weight of the object. The focusing is accomplished by means of rack and pinion adjustments acting directly upon the stage. The objective, which is permanently aligned with respect to the optical axis, is not moved. The vertical column supporting the stage and unit base is provided with broad bearing surfaces so that large and heavy specimens will not interfere with easy focusing. Coarse adjustments are made by means of a large wheel that actuates the rack and pinion movement. Fine adjustments are made by means of a micrometer screw or a focusing rod from the plate end of the camera.

A scale is engraved on the rack slide so that the position of the stage can be quickly set for different objectives.

The vertical illuminator is fitted with a sliding plate by means of which it may be removed from the microscope if desired. It is centered with reference to rotation about its vertical axis and is locked in position. A stop is provided to maintain one reflector at exactly 45 deg. of the axis of the objective. The opening in the side of the illuminator is fitted with a short tube in which is mounted a small condensing lens, a sliding diaphragm with four apertures, and two glass filters. These filters produce approximately monochromatic light.

The illuminating system is rigidly supported by a stand that is a unit with the stand of the inverted microscope. With this construction permanent alignment of the three-element condensing system with the center of the supplementary condenser on the side of the vertical illuminator is assured. The condensing lens is fixed in place for all objectives. By means of an iris diaphragm mounted in a rotating holder with de-centering adjustment, it is possible to illuminate the specimen by oblique rays from any direction. A central stop provides for conical illumination.

The source of light may be either



Bausch & Lomb Metallographic Equipment, Model GB-ILSAA

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an automatic-feed arc lamp or a 6-volt, 108-watt, ribbon-filament Mazda lamp. The clock feed mechanism of the arc lamp controls the carbon holders by means of a constant chain drive, and it is claimed that a steady and uniform arc of high intensity results. The travel of the carbon holders is sufficient to accommodate the full length of 6-in. carbons in one setting, so that two hours of steady light can be maintained.

The Mazda lamp is always in alignment, but since its light is much less than that from the arc, the length of exposure must necessarily be longer.

The camera consists of a tapering bellows of 40-in. extension with front and rear supports and a center frame to prevent sagging. The camera back is reversible and is provided with a hinged door and a plate holder for 8x10-in. plates. The front support is fitted with an exposure shutter and a light-tight connector to the microscope.

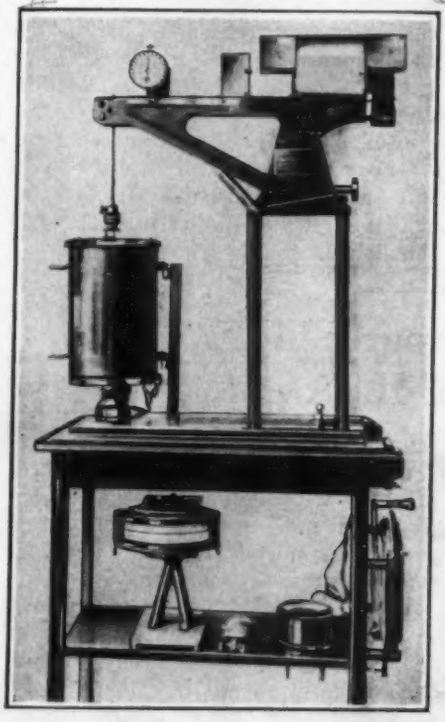
The supporting base has been improved. It consists of a heavy steel bar for holding the camera parts and a section of milled optical bed for the microscope. The two parts are carefully joined together and are provided with low supporting feet at either end. The bar is graduated in millimeters for the easy determination of the bellows draw. The entire unit is mounted upon spring shock absorbers cushioned by sponge rubber dampers.

The improved camera back consists of a frame interposed between the rear bellows frame and the camera back proper, in which there is mounted a telescopic magnifier with a right-angle prism, which faces toward the eyepiece of the microscope. The microscope is adjusted until the image is in focus on the cross hairs. The system is so designed that this adjustment gives correct focus on the plate as well. The back is also provided with a supplementary dark slide which is raised by means of weights.

Rockwell Dilatometer, Type L. A.

The Stanley P. Rockwell Co., 66 Trumbull St., Hartford, Conn., has placed upon the market a complete laboratory outfit intended primarily to be used in research work in connection with the heat-treatment of steel. It can also be used for the hardening of small dies and tools in the shop.

The outfit consists of a small electric furnace with rheostat to control and an ammeter to measure the flow of current, and a Rockwell type L. A. Dilatometer to indicate mechanically



Rockwell Type L. A. Dilatometer

the volumetric changes that take place in the block of steel under observation as its temperature increases. A pyrometer is furnished only upon specification.

The Dilatometer consists primarily of an amplifying lever, to the short end of which is attached a quartz rod that bears directly upon the die or other tool in the furnace. The long end of the lever carries a stylus to record graphically upon a moving chart a diagram that shows, many times magnified, the actual movements of the steel under the influence of the changing temperatures.

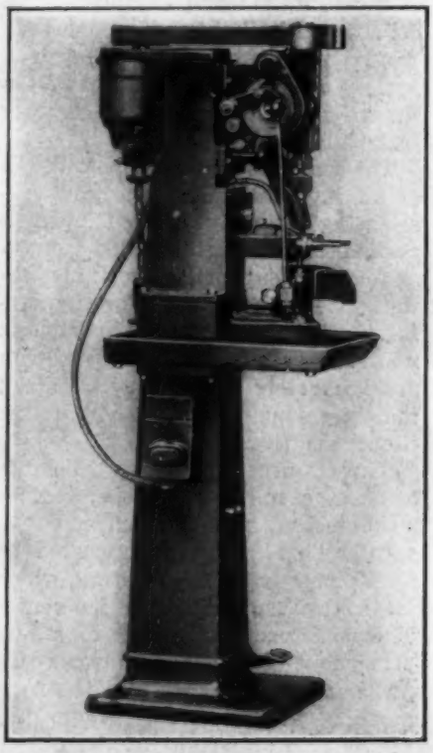
Connected to the same end of the lever is a relay, by means of which the instrument is made to ring a bell to attract the attention of the operator at the instant the heated steel is ready to be quenched. A dial gage, the measuring spindle of which bears upon the lever, affords visible indication of the direction and rate of the lever movement.

The principle of the Dilatometer is based upon the relation between the volumetric change of the steel while passing through the critical range and the corresponding change in its physical structure that renders possible the condition of hardness. Under the influence of increasing temperature, the steel expands uniformly until the point of decalescence is reached—then it contracts during a further short rise in temperature, after which it again expands. The beginning of the re-expansion period indicates the point at which the steel should be quenched.

Kingsbury Semi-Automatic Drilling Machine

The Kingsbury Machine Co., Keene, N. H., is marketing the semi-automatic drilling machine illustrated. The machine incorporates this company's standard drilling head and a burring attachment. It is primarily intended for drilling and burring holes in pins.

The unit is driven by means of a



Kingsbury Semi-Automatic Drilling Machine

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ball-bearing motor mounted on the rear of the column. Interchangeable pulleys are supplied to give spindle speeds up to 7,000 r.p.m. with a 3,500-r.p.m. motor.

The drill spindle has a constant-pressure feed, regulated by means of a knurled adjusting screw, and actuated through friction gearing. The spindle is advanced rapidly to drilling position, and when resistance is encountered, the gears begin to slip, thus producing constant pressure. The rate of feed varies as the resistance. The feed is engaged by means of a clamp nut placed integral with the hand-feed lever.

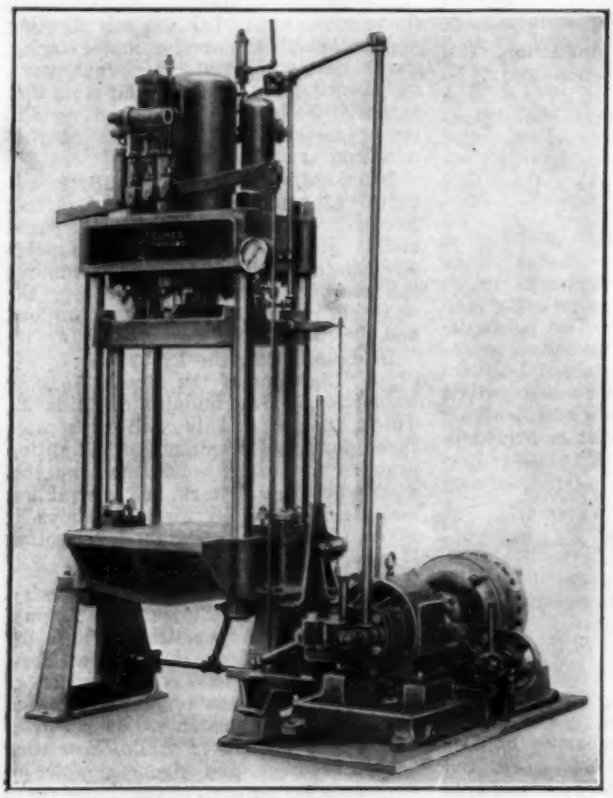
An automatic clamping attachment is provided, together with adjustable V-blocks for holding work up to ¾ in. in diam. A spring plunger is used to eject the work. The work cycle is as follows: The operator inserts a blank and depresses a treadle, which trips the spindle feed. The work is then automatically clamped, drilled, countersunk on the bottom of the hole to remove the burr, unclamped, and finally ejected.

A tank and pump are located within the pedestal for supplying coolant to the drill. The driving motor is controlled by means of a Westinghouse starter.

Elmes Hydraulic Press, 50-Ton

The 50-ton hydraulic press illustrated is being marketed by the Charles F. Elmes Engineering Works, Morgan & Fulton Sts., Chicago, Ill. The press operates in conjunction with a Hele-Shaw hydraulic pump, direct-connected to a 7½-hp. electric motor. The press is adapted for straightening steel castings and for general shop purposes.

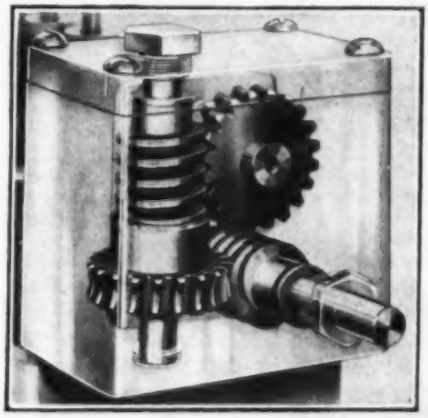
The differential ram principle is used on this machine to obtain high speed of operation. Two minor cylinders and one large cylinder are employed in parallel. The initial and rapid down-travel is effected by the minor rams, and during this period the main cylinder is pre-filled from an overhead tank. When a resistant pressure is encountered, the pump pressure is admitted to the main cylinder. The ram then descends at low speed. The pump runs continuously and its discharge can be controlled within close limits so that a wide range of ram speeds can be obtained. The pump can also be reversed. An automatic stop releases the pump pressure at the completion of the return stroke, and a device is provided to maintain the ram in the top position even though the pump be idle. The rams are packed from the outside with a fibrous, compression type of packing. The maximum opening under the ram is 27 in., while the maximum travel is 18 in. The platen measures 24 x 30 in. The machine occupies a floor space of 4 ft. x 5 ft. 10 in. and has an overall height of 8 ft. The machine weighs 5,100 lb. without the motor.



Elmes Hydraulic Press, 50-Ton

Hill-McCanna Speed Reducer, Fractional-Horsepower

The Hill-McCanna Co., 2025 Elston Ave., Chicago, Ill., is marketing the fractional-horsepower speed reducer illustrated. Ratios ranging from 50 to 1 to 400 to 1 are available in a space of 4 x 2 x 4 in. A combination of two pairs of worm and wheel is used to obtain this reduction.



Hill-McCanna Speed Reducer, Fractional-Horsepower

The worms are hardened steel and the wormwheels are bronze. The entire mechanism operates in a grease-packed, dust-proof case. Stuffing boxes are used at the points of entrance of the high- and low-speed shafts to retain the grease.

The high-speed shaft is ½ in. in diam. It is connected to the driving motor by means of a flexible coupling. A pulley can also be mounted upon this shaft for belt drive. The unit is suitable for use with motors up to ½ horsepower.

"Groov-Pin" Self-Locking Pin

The Groov-Pin Corporation, 4522 38th St., Long Island City, N. Y., is marketing the self-locking pin illustrated for use in fastening machine parts. The pins are designed to eliminate the reaming of drill holes.

The pin is manufactured by grooving on three sides a cold-drawn,

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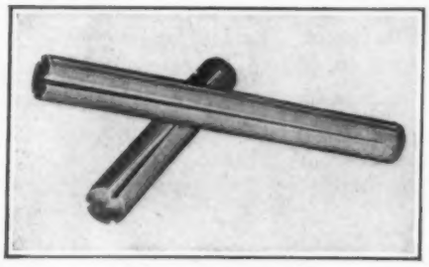
alloy-steel cylindrical pin. The work is done on special machinery. The steel employed has a tensile strength of 80,000 and 90,000 lb. per sq.in. The grooves are made wider at the upper end and gradually narrow until they disappear a short distance from the other end of the pin. Two lengths of grooves are furnished: one extends approximately 80 per



"Groov-Pin" Self-Locking Pin

cent of the length of the pin, and the other one-half the length of the pin. These grooves form three sectors, which are pressed out in proportion to the depth of the groove. In this way the pin becomes tapered from the lower to the upper end. When the pin is driven into a drilled hole, the three sectors press against the face of the hole and make the pin self locking.

The pins are available in sizes ranging from $\frac{3}{16}$ to $\frac{1}{2}$ in. in diam. Sizes up to $\frac{3}{4}$ in. in diam. are contemplated.

"Jalcase" Steel

The Jones & Laughlin Steel Corporation, American Steel and Iron Works, Pittsburgh, Pa., is marketing an improved open-hearth steel especially adapted for casehardening and for forgings where machinability is most important. The steel is called "Jalcase" and can be furnished in the form of either hot-rolled or cold-rolled bars, as desired.

Jalcase is especially processed, and it contains a new combination of elements that have not been used previously in alloy steels. The following properties are claimed for this metal: It has free-cutting qualities equivalent to Bessemer screw stock. It is superior to the carbon grades of case-carburizing steels, and it approaches the alloy grades. It develops a hard, wear-resisting, normal case, free from soft spots, and it possesses a tough ductile core.

Jalcase is recommended for case-carburized parts that are subjected to severe abrasive wear, high stresses, or repeated shocks. It is also recommended for case-hardened forgings or for forgings in which machinability is a decisive factor. In combination with its free-cutting properties, it has the ability to withstand cold heading, so that it should make a desirable steel for cold-headed bolts, cap screws, and similar work.

It is further claimed that the use of this steel will result in lower costs since the cutting speed can be increased, the carburizing time decreased, and fewer corrections have to be made for distortions after hardening.

Trade Catalogs

Lathes, Production. The Porter-Cable Machine Co., Syracuse, N. Y., has issued a 16-page bulletin on its "Hi-Speed" production lathes. The various features of the machine are described and illustrated by means of photographs. Several examples of multiple tooling operatings are also shown by means of line drawings.

Motor-Generator Sets, Induction. The General Electric Co., Schenectady, N. Y., has issued a bulletin on its induction motor-generator sets ranging in capacity from 1 to 35 kw., 125 or 250 volts. The bulletin is illustrated and is perforated for insertion in a loose-leaf folder.

Planers, Woodworking. Wadkin & Co., North Evington, Leicester, England, have published a 28-page pamphlet on its combined surface planing and thicknessing machines. The construction of the machine is described in detail and instructions are given as to its proper use. Typical jobs are described and illustrated. Complete specifications are included. The booklet is profusely illustrated by means of photographs and line drawings.

Threading Machines, Automatic. The Rickert-Shafer Co., Erie, Pa., has published Bulletin No. IX. series No. 1-D, on its "R-S" automatic double-spindle threading and second-operating machines. Important features are described and several views of the machine are shown to supplement the text.

Welding Apparatus, Arc, Semi-Automatic. The General Electric Co., Schenectady, N. Y., has issued bulletin GEA-453 on its semi-automatic arc welding apparatus of the jib-crane type for tank welding. The bulletin is illustrated.

Pamphlets Received

Castings, Steel, Electric-Furnace. The Lebanon Steel Foundry, Lebanon, Pa., is issuing a series of technical bulletins on electric furnace steel castings. The bulletin describes the operations of an electric-furnace steel foundry in an elementary way for the information of users of this class of castings.

Twelve bulletins have been issued to date. The first describes the rise of the steel casting industry, while the second tells of the growing use of electric-furnace steel castings. The three following bulletins describe the various characteristics of these castings, while in the next three molding sand cores are discussed. Bulletins 9 and 10 are devoted to patterns and pattern mounting, while Bulletins 11 and 12 describe the core and molding departments, respectively. The bulletins are profusely illustrated by means of photographs, line drawings and charts. Treatment of the subjects is entirely technical in character.

Lighting Data. The Edison Lamp Works of the General Electric Co., Harrison, N. J., has issued three bulletins in their "Lighting Data" series. Index 13, Bulletin LD 117C, is entitled "Calculation of the Lighting Installation." It contains 36, 6x9-in. pages. Information is given by text and numerous tables on such subjects as recommended foot-candle levels for various lighting applications both interior and exterior, the selection of reflecting equipment, and the location of outlets and mounting height. Both the lumen and candlepower methods of calculation of illumination are given.

Index 35, Bulletin LD 108B, is entitled "Lighting of Offices and Drafting Rooms." It contains 24, 6x9-in. pages and is illustrated by means of numerous photographs. The text compares the various systems of lighting, the wattage required, spacing of outlets, and the like.

Index 62, Bulletin LD 134A, is entitled "Lighting of the Metal Working Industries." The bulletin contains 32, 6x9-in. pages and is well illustrated throughout. Recommended lighting practice for bench work, machine tool work, sheet metal work, and assembling and paint work in machine shops is given. Steel mill and foundry lighting is also included.

Physical Examinations in Industry. Industrial Health Series No. 2, published by the Metropolitan Life Insurance Co., 1 Madison Ave., New York. This pamphlet discusses the benefits to be derived from the physical examination of labor applicants. It suggests what tests should be made, how they should be made, and gives examples of numerous forms used in collecting these data. A list of equipment and facilities needed is also given.

News of the Week

Cincinnati and Heim in Consolidation

Cincinnati Grinders, Inc., was incorporated at Columbus, Ohio, on Sept. 10 with an authorized capital of $1,500,000 common stock. On Sept. 11 the company took over the grinding machine business of the Cincinnati Milling Machine Co. and the centerless grinder business of the Heim Grinder Co., of Danbury, Conn. At the same time it was announced that the new company had acquired the Triumph Electric plant at Oakley and would immediately convert this property into a modern grinding machine plant. The new plant is expected to be in operation early in 1927 and will commence work with a force of several hundred mechanics.

The Cincinnati Milling Machine Co. entered the grinding machine field about five years ago and in that period has made rapid progress in the development of certain types of machines. For the past year its plant has been operating on a day and night schedule. Officers of Cincinnati Grinders, Inc., are as follows: P. O. Geier, president; George W. Binns, secretary; F. M. Angevin, formerly of the Heim Grinder Co., treasurer. R. C. W. Harrison, formerly grinding machine engineer for the Churchill Machine Tool Co., Manchester, England, is a director of the company. C. Booth, formerly works manager of the Heim Grinder Co., and previous to that engineer with the Heald Machine Co., W. Peaslee and P. H. Cone are also on the board.

British Engineering Industry Reveals Surprising Strength After Strike

Machine tool group has had worse seasons

BY OUR LONDON CORRESPONDENT

The coal dispute has long been the outstanding feature of the industrial situation. Its effect on engineering has been direct, many orders being withheld, while foundries are unable to give a satisfactory supply of castings owing to difficulty in obtaining pig iron and coke of the right quality. While stocks approach the vanishing point, the production of pig iron, etc., has almost stopped. Increases in price are expected, both for fuel and pig iron, with the resumption of work by the miners.

In view of the length of the coal dispute, the present position of engineering is somewhat surprising. Night shifts have been reported in connection with some automobile plants. The machine tool section might have dnoe worse, and some merchants have actually reported better orders than last year. But shortage of raw materials must have its effect, direct and indirect, and the condition of the machine tool industry must be described as rather dull. Some firms are just kept going, while few could be described as busy. It may be that the best light on the estimated prospects of the engineering industry is shed by the action of the trade unions concerned in connection with an application for 20s. advance in weekly wages. Negotiations have been in progress for about two years and before the general strike the employers made an offer, which was nowhere near the demand, and on terms. Recently a conference was held of representatives of some twenty-five engineering and shipbuilding unions. After hearing reports from various districts, the conference decided, in view of the current industrial situation and the circumstances of the engineering industry, that the application should be postponed until conditions were more favorable. General unemployment fluctuates slightly, but out-of-works exceed 1¼ millions, being about one-third of a million more than a year ago, as shown on the labor exchange registers. The figures do not, of course, include persons connected directly with the coal mining dispute.

While engineering in this country has undoubtedly suffered, though not to the extent that had been anticipated, most firms are fully optimistic and many inquiries for enginering supplies from overseas have been received. The automobile season has of course closed. For the most part the season has been at least as satisfactory as could be expected. One well-known firm has reported exceptional prosperity, as shown by its distribution of profits; others have had to admit the effect of the industrial upset.

Further efforts as regards exports are being made. Something is expected too, more particularly perhaps by Sheffield firms, from government and other developments in aircraft, and the all-metal seaplane has developed. An all-duralumin construction has become possible.

Textile machinery makers could do with more orders. In electrical work the most important project is the extension of electric traction on the Southern Railway at a cost of about 3¾ million pounds. The system will be unified, the third rail being generally employed and displacing in some areas the existing overhead system which had been installed by one of the constituent railway companies. The opening of an extension to one of the tubes will also, it is claimed, provide London with the longest tube railway in the world. Good orders for rolling stock, etc., have been reported from India, whence also have come a number of orders for agricultural machinery. Agricultural engineers have, in fact, been in a happier position in recent weeks.

To return to the general position. The latest official returns suggest a definite tendency towards improvement in exports, though so far the figures are below those of last year, when Great Britain did about 12 per cent of the world's export trade, as compared with 13 per cent pre-war. Meanwhile, reports suggest to us that America, or at least the United States area, is a land flowing with milk and honey and that gold has to be hidden—it is so plentiful. Investigators, individual and organized, are turning their eyes in your direction, and a government-appointed delegation, including employers and employed, is among you making notes.

[Since this letter was received from our correspondent, the coal strike in England has been definitely settled according to newspaper reports. The above description of conditions during the strike should give the reader an excellent basis to study post-strike developments.—EDITOR.]

R. M. Hudson to Preach Waste Elimination

The economic and industrial significance of the movement for the elimination of waste and the gains resulting therefrom to manufacturers, distributors and consumers, will be discussed by Ray M. Hudson, chief of the division of simplified practice of the Department of Commerce, who is to be guest speaker of a number of meetings which have been scheduled to take place in Spokane, Seattle, Tacoma, Portland, San Francisco, Oakland, Los Angeles, San Diego, Salt Lake City, Ogden, Denver and other Western cities during September and October. These meetings are being held under the joint auspices of manufacturers associations, purchasing agents associations, chambers of commerce, rotary clubs, management associations and other groups interested in this subject.

Mr. Hudson is directing the work of the division of simplified practice which was established in 1921 by Secretary Hoover to serve as a centralizing agency in bringing producers, distributors and users together.

New Haven Show Emphasizes Advances Made in Design and Operation of Machine Tools

Extended application of ball and roller bearings and reduction of manual effort seen as outstanding development of present era

The sixth annual exhibition of machine tools, small tools, and allied products, held under the auspices of Yale University, the American Society of Mechanical Engineers, and the New Haven Chamber of Commerce, opened Tuesday evening, Sept. 7, at the Mason Laboratory of the Sheffield Scientific School, and continued through the week until 10 p.m. Friday evening.

The exhibition, which began in a tentative way six years ago, through the effort of small groups of men in the organizations mentioned above, has developed year by year, until it has reached proportions of national importance.

It has never been the desire of its promoters to make this exhibition a "big show"; rather have their efforts been directed toward the concentration of that which is new in machine tools and to the dissemination of ideas that will make for the progress of the industry as a whole.

Notable among the achievements of the past year has been the extended application of roller and ball bearings to machines and purposes for which they have not hitherto generally been deemed suitable. Reduction in the amount of manual effort necessary to operate the machines was another feature, many of the larger machines being equipped with power-traversing mechanisms for positioning the heavier members.

Mechanical Perfection

Elimination of the "personal factor" to the greatest practicable degree has received attention, and upon some of the machines shown it is possible to position the parts, make the necessary cuts, and effect accurate sizing of the product within limits of error that compare very favorably with the work of a skillful toolmaker, and do it entirely by mechanical means.

There has been a notable advance in the application of pneumatic chucking and work-handling devices, whereby the operator of high-production machines is relieved of a great deal of physical exertion as well as mental tension, and is able to turn out a more uniform product in greater quantity and with less fatigue.

With the progress in the direction of mechanically operated movements it has been possible to secure greater strength by the addition of extra material wherever such addition has been found desirable, with the result that the machines have been made more rigid and dependable, and are able to sustain higher cutting speeds and heavier feeds.

Automaticity is an end that the machine tool builder has striven to attain. Many production machines were shown, in the operation of which the operator is called upon only to set the work in the chuck or other holding device and to remove it when finished.

Cutting tools are heavier and stronger in order to take the fullest advantage of the peculiar properties of high-speed steels, of which more and more of such tools are being made. Inserted-tooth milling cutters, the bodies of which are almost universally made of heat-treated steels, were much in evidence. Forming and other special cutting tools are also made in the same manner and from the same materials.

The increasing use of the gas and electric welding processes was evidenced by the number and character of devices applicable to this process on display. Electric and gas-fired furnaces indicated the modern trend toward these forms of heating units.

Technical Sessions

The technical sessions were well attended. At the first session, at which Clayton R. Burt, vice-president and general manager of the Pratt & Whitney Co., was chairman, the papers presented were: "Sane Specifications and Intelligent Inspecting," by General C. L'H. Ruggles, chief of manufacturing, Ordnance Dept., U. S. A.; and "The Group Drive and Individually Motorized Drive," by F. H. Penny, of the industrial engineering department of the General Electric Co., of Schenectady. Of these, an abstract of the first was published in the Sept. 2 issue of *American Machinist*.

At the second session, under the chairmanship of Carl Dietz, president of the Bridgeport Brass Co., Dexter S. Kimball, dean of the college of engineering at Cornell University, spoke on the subject, "Decoration and Proportions of Machines"; and Herman S. Hall, superintendent of the Connecticut State Trade School of New Britain, read a paper that had been prepared by Harold S. Falk, vice-president and general manager of the Falk Corporation, Milwaukee, Wis. The title of Mr. Falk's paper was "The District Apprenticeship System." An abstract of this paper was published in the Sept. 9 issue of *American Machinist*.

In his talk, Dean Kimball referred to the complaint frequently made that the artistic is neglected in design, pointing out in explanation that the development of machine design passes through the three stages of utility, decoration, and purpose. Progress is made either empirically or scientifically.

During the talk, slides were used to show the old types of design when purpose was not the chief aim. Greek columns were used, engines were given lines to conform to certain settings, and so on. The automobile was cited as an example of present-day scientific and purposeful design, which naturally incorporates beauty, giving at the same time the impression of speed and power.

Stoves, typewriters, locomotives, and automobiles were shown to have passed through the three stages of design. So have machine tools, which are acquiring beauty as their design becomes more purposeful. In general, beauty is proportional to the purpose back of the design.

Machine Tool Session

W. F. Dixon, works manager of the Singer Manufacturing Co., and chairman of the A.S.M.E. machine shop practice division, presided at the third session. Papers were presented as follows: "Cold Press Finishing of Metal in Interchangeable Manufacture," by R. V. Crane, of the E. W. Bliss Co.; and "The Influence of Elasticity and Errors in Tooth Shape on Stresses in Gears," by John E. Nicholas.

Representatives of several machine tool and equipment builders spoke at a symposium on the subject, "What's New in the Machine Tool Industry?"

Meetings of committees were as follows: Sectional Committee on Standardization of Plain and Lock Washers; Sectional Committee on Standardization of Machine Pins; Central Committee on Standardization of Small Tools and Machine Elements; A.S.M.E. Special Committee on Gears—Progress Report; Sub-Committee No. 5 of the Committee on Standardization of Shafting, reporting on Woodruff Keys; A.S.M.E. Special Research Committee on Gears.

There was an organization meeting of the Committee on the Standardization of Machine Tapers, this committee being a sub-section of the Committee on Standardization of Small Tools and Machine Elements.

The attendance at the exhibition was quite equal to that of previous years, and was representative of the machine tool industry throughout all sections of the country. Several representatives of foreign machinery builders also were present.

On the social side, sight-seeing tours and visits of inspection in and around New Haven were arranged. Special luncheons and round table dinner discussions were arranged at which subjects of general interest to machine tool men were discussed.

Exhibitors Represented at the Show

Air Reduction Sales Co., 342 Madison Ave., New York, N. Y.

American Engineering Co., Philadelphia, Pa.

Baush & Lomb Optical Co., Rochester, N. Y.

Bliss, E. W. & Co., 53d St. and 2d Ave., Brooklyn, N. Y.

Botwinik Bros., New Haven, Conn., representing: Ames Company, Brooklyn, N. Y.; Carroll & Jamieson, Cincinnati, Ohio; Davis Keyseater Co., Rochester, N. Y.; Draver Manufacturing Co., Richmond, Ind.; Hisey-Wolfe Machine Co., Cincinnati, Ohio; Rockford Iron Works, Rockford, Ill.; Sloane & Chace Manufacturing Co., Newark, N. J.; Zeh & Hahnemann, Newark, N. J.

Bristol Company, Waterbury, Conn.

Brown & Sharpe Manufacturing Co., Providence, R. I.

Buffalo Forge Co., Buffalo, N. Y.

Bullard Machine Tool Co., Bridgeport, Conn.

Burke, L. D., New Haven, Conn., representing: Pennsylvania Pump and Compressor Co., Easton, Pa.

Carborundum Company, Niagara Falls, N. Y.

Clark, Jas. Jr., Electric Co., 242 Lafayette St., New York, N. Y.

Cleveland Automatic Machine Co., Cleveland, Ohio.

Clipper Belt Lacer Co., Grand Rapids, Mich.

Dycast Steel Co., Collinsville, Conn.

Eastern Machine Screw Corporation, New Haven, Conn.

Engineering, J. B. Co., New Haven, Conn., representing: Cleveland Worm and Gear Co., Cleveland, Ohio.

Fafnir Bearing Co., New Britain, Conn.

Frew Machine Co., Philadelphia, Pa.

General Electric Co., Schenectady, N. Y.

Geometric Tool Co., New Haven, Conn.

Heald Machine Co., Worcester, Mass.

Keller Mechanical Engineering Corporation, Brooklyn, N. Y.

Leland-Gifford Company, Worcester, Mass.

Machinery Dealers Inc., New Haven, Conn.

Mersick, C. S. & Co., New Haven, Conn., representing: Boston Gear Works, Norfolk Downs, Mass.; Bearium Bearings, Inc., Buffalo, N. Y.; Lewellyn Manufacturing Co., Columbus, Ohio.

National Acme Co., Cleveland, Ohio.

National Machinery Co., Tiffin, Ohio.

New Britain Machine Co., New Britain, Conn.

New Departure Manufacturing Co., Bristol, Conn.

New Haven Gas Light Co., New Haven, Conn.

Noble & Westbrook Manufacturing Co., Hartford, Conn.

Norma-Hoffmann Bearings Corporation, Stamford, Conn.

O. K. Tool Co., Shelton, Conn.

Oxweld Acetylene Co., Long Island City, N. Y.

Potter & Johnston Machine Co., Pawtucket, R. I.

Prentiss, Henry & Co., Hartford, Conn,. representing: Acme Machine Tool Co., Cincinnati, Ohio; Avey Drilling Machine Co., Cincinnati, Ohio; Cincinnati Bickford Tool Co., Cincinnati, Ohio; Cincinnati Milling Machine Co., Cincinnati, Ohio; Goss & DeLeeuw Machine Co., New Britain, Conn; Oilgear Co., Milwaukee, Wis.; V. & O. Press Co., Hudson, N. Y.

Purinton & Smith, Hartford, Conn., representing: Abrasive Machine Tool Co., East Providence, R. I.; Barrett, Leon J. Co., Worcester, Mass.; Black & Decker, Baltimore, Md.; Cochrane-Bly Co., Rochester, N. Y.; Foote-Burt Co., Cleveland, Ohio; Jacobs Manufacturing Co., Hartford, Conn.; Kingsbury Machine Co., Keene, N. H.; Monarch Machine Tool Co., Sidney, Ohio; Peerless Machine Co., Racine, Wis.; Rhodes Manufacturing Co., Hartford, Conn.; Rivett Lathe & Grinder Co., Boston, Mass.; Wallace, J. D. Co., Chicago, Ill.; Yale & Towne, Stamford, Conn.

Racine Tool & Machine Co., Racine, Wis.

S.K.F. Industries, Inc., 165 Broadway, New York, N. Y.

Sichel, L., 200 Fifth Ave., New York, N. Y.

Standard Machinery Co., Auburn, R. I.

Taylor & Fenn, Hartford, Conn.

Timken Roller Bearing Co., Canton, Ohio.

Torrington Co., Torrington, Conn.

Van Norman Machine Tool Co., Springfield, Mass.

Warner & Swasey Co., Cleveland, Ohio.

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

Dean Kimball Honored at New Haven by Testimonial Dinner

An occasion of pronounced interest at the sixth annual New Haven Machine Tool Exhibition was the dinner in honor of Dean Dextor S. Kimball by the exhibition committee. The dinner was in the nature of a tribute to a very well known engineer, educator and author, upon his visit to an exhibition of machine tools, named the "Master Tools of Industry" by himself. It seemed especially appropriate that the dinner was held in an educational city as a part of a program of the A.S.M.E., of which Dean Kimball is a past president, and in connection with an exposition to which Yale University as well as the A.S.M.E. has lent its support.

Dextor Simpson Kimball

Dean Kimball, now of the College of Engineering, Cornell University, was an apprentice with Pope & Talbot, Port Gamble, Wash., from 1881 to 1887; worked in the shops of the Union Iron Works, San Francisco, from 1887 to 1893; took a B. S. degree in 1896 and an M. E. degree in 1913 at Stanford University; worked in the engineering department of the Union Iron Works from 1896 to 1898; was designing engineer with the Anaconda Mining Co. in 1898; was assistant professor of machine design at Cornell University from 1898 to 1901; served as works manager of the Stanley Electric Manufacturing Co. from 1901 to 1904; was professor of machine design at Cornell from 1904 to 1915; was professor of industrial engineering at Cornell from 1915 to 1926; and became Dean of the College of Engineering in the same university in 1926.

Dean Kimball is the author of a number of technical books, has held several positions of engineering and public importance, and is now president of the American Engineering Council.

In an informal talk Dean Kimball remarked upon the importance of machine tools as the machines by which other machines are made; remarked upon the impossibility of any of our present development without the aid of the "master tools of industry"; and pointed out the futility of trying to predict the engineering developments of the future in any industry.

Educational Value of Museums to Invention

Calvin W. Rice, secretary of the A.S.M.E., told of the present state of development of the industrial museum abroad and pointed out the tendency toward establishing similar museums in the United States, emphasing their educational value and their worth as incentives toward further invention and development.

Harry R. Westcott, chairman of the managing committee, presided as toastmaster.

Aero Chamber Elects Paul Henderson

At the fifth annual meeting of the members and board of governors of the Aeronautical Chamber of Commerce of America, held on Aug. 26, the following officers were elected: President, Paul Henderson; first vice-president, F. H. Russell; second vice-president, F. B. Rentschler; third vice-president, R. H. Fleet; treasurer, C. H. Colvin; secretary, C. T. Ludington; assistant treasurer and general manager, S. S. Bradley; assistant secretary, Owen Shannon.

The members of the board of governors, in addition to the above, are: C. L. Lawrence, Grover Loening, Donald Douglas, A. V. Verville, L. B. Valentine, L. D. Gardner, R. G. Thach.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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FOR a week that included Labor Day and the Jewish New Year, business has been remarkably active and the autumn seems to be opening auspiciously.

From the summer White House at Paul Smith's daily bulletins setting forth the President's confidence in our continued prosperity have been given out and the phrase "political economy" is coming to have a new significance as it becomes apparent that the issue in the fall campaign will be "good times versus tariff reform." Under old-time conditions there would be no doubt of the result, but Senator Lenroot's defeat in the Wisconsin primaries has made some Eastern Republicans a little fearful that the so-called radicals will hold the balance of power in the next Congress.

But it will be the fourth of March before the newly elected Congress convenes and lots of things can happen in the interval. Therefore, it may be unwise to look too far ahead, and most people are content to enjoy the good times the gods have brought us while keeping a weather eye open for the change that must come sometime.

This disposition is reflected in the stock market where there was a further advance early in the week. The railroad shares were the leaders on record car loadings and July net earnings that were $17,000,000 in excess of last year's figures for the same month.

Some industrials were also higher and the oil shares were particularly strong upon a government report which asserted that the visible supply of oil in the United States would be exhausted by 1932. It is difficult to understand why the exhaustion of our oil resources should be regarded as a bullish pointer on the stocks of the oil producing companies, but there are times when nearly all news is optimistically construed and the present seems to be a period in which everyone prefers to take the roseate view.

Meantime, it is worth noting that brokers' loans continue to increase and that money has advanced to 5 per cent for both call and time loans. Of course, there are lots of precedents for a bull market with dear money, but such movements have never lasted very long and those who have any respect for financial tradition will continue to believe that interest rates and security prices move inversely. For this reason caution seems advisable in following a further advance in the stock market, for it is an old maxim that at high altitudes accidents generally favor the bears.

The dry goods trade in particular is better than for some time. Silks and woolens are in excellent demand at stable prices and the American Woolen Co. announces that all its plants are running full time.

Cotton textiles are moving in unusual volume and prices are firm despite a government crop estimate which disappointed the bulls and caused a sharp decline in cotton futures. The trade seems to be coming to the conclusion that there can be no real scarcity of cotton this season and that the price will depend upon the farmer's ability to market his holdings gradually, rather than upon the eagerness of buyers.

In the steel industry the feeling seems to be cheerful but prices are no higher and only a few mills are running at full capacity. A further curtailment in building is reported and permits issued in July call for an expenditure of $298,000,000 as against $326,000,000 in the same month last year.

The wheat situation is puzzling. The United States has an exportable surplus of about 300,000,000 bu. and there are some predictions that Canada will produce 400,000,000 bu. This is a formidable supply, and although the market has had some fainting spells, it is really surprising that it has stood up as well as it has. Certainly there is nothing but a large short interest upon which to base operations for an advance.

Corn has also shown steadiness, but there is little or no speculation on the commodity exchanges and any decline in prices will come as a result of producer selling rather than bull liquidation.

The most important news from Europe is that Germany has been admitted to the League of Nations and made a member of its Council. This augurs well for the world's peace. Spain, on the other hand, has adhered to her withdrawal from the League and finds herself confronting a possible revolution. The military revolt appears to have been suppressed, but the outcome of a plebiscite about to be held is still obscure.

But neither happening has any immediate economic significance and the interminable British coal strike presents about the only foreign problem that American business men need consider. Thus far its effect has been to increase the demand for American coal, but unless it is ended soon it may seriously sap the purchasing power of our best customer overseas. In the latter aspect it is of great importance to this country, for if it is not settled before the winter sets in, it will mean great distress in England. It is about the only dark cloud on a horizon that is otherwise indicative of a fine tomorrow on both sides of the Atlantic.

Sugar has been firm and Cuban raws are selling at the highest prices of the year. The consumption for 1926-27 promises to exceed the production, if the Cuban crop is restricted.

What's Doing in Industry

The first half of September brought the beginning of a revival of sales in machinery and machine tool lines, following the falling off in the last half of August. The quantity and quality of inquiries received by manufacturers and dealers in the past six weeks indicated a good fall business, and the trend of present sales seems to bear out the prediction. A feature of this business is the buying by firms which have not been active in several months. Orders are scattered and call for a wide variety of shop equipment.

The New England territory reports an improved condition, with export business showing up well. Dealers and agents in the New York market are pleased with the trend of business, orders coming from unexpected sources and making a satisfactory volume. Buffalo continues with a fair volume of new orders received from a variety of users of tools.

The Mid-West reports gradual improvement in practically all important sections. Detroit reports many orders for single pieces, with the inquiry volume forecasting good fall business. Chicago has received new encouragement from manufacturers of automobile accessories and electrical apparatus. Export business has revived in Cincinnati and manufacturers report increased orders from abroad. Production activity is running high in Milwaukee and pending inquiries promise to support this activity.

General business conditions throughout the country continue prosperous. Most people are content to enjoy the good times the gods have brought us, while keeping a weather eye open for the change that must come sometime.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

New England manufacturers of machine tools were gratified with the success of the annual exposition which closed last week at New Haven, Conn. Visitors and prospective buyers from even Mid-Western manufacturing centers were attracted. The concensus of opinion of manufacturers is that the outlook for the ensuing six or eight months is especially bright and production will have to be increased to keep pace with demand.

Buying during the past fortnight has continued active with an increase in demand for foreign shipments. Manufacturers of chucks and dies report increasing sales abroad and it is believed that some of this buying is for stock. Orders from the Orient and Italy have been received. Manufacturers of railroad equipment are giving replacement orders in this territory. Business in Bridgeport is improving. Springfield and Worcester manufacturers report better buying of machinery in general.

New York

Perhaps the most promising feature of the present market for machinery and machine tools in this territory is the fact that orders are coming in from industries that have been inactive as buyers for several months. It is also evident that the widespread industrial activity among users of machinery is responsible for much of the present inquiry. While actual sales have been only fair, there is more selling activity in this market now than has been evident in the past two months.

Little business is reported from railroads, it being the opinion of more than one authority that sales to this source have about reached the limit of this year's appropriations. Manufacturers of electrical goods, automobile accessories and general machine shop operators are the best buyers. Dodge Brothers, Delco Light, General Electric and Chevrolet are also mentioned as recent buyers.

Sales for the past week included: A 72-in. boring mill, an 18-in. engine lathe, a vertical shaper, a jig borer, 7 automatic lathes, 2 vertical drill presses, four 16-in. engine lathes and a 14-in. tool grinder.

Buffalo

There are some marked indications reported by equipment dealers of an upturn in business in September, and it is interesting to note that in some cases it was reported that the August business was better than that of July.

There was a slight flattening out of business around Labor Day but this was considered as due to the last vacation fling of the public.

Most orders are small and no big ones are in sight at this time, but the business is coming from a wide variety of industries and the number creates a good volume. Some report inquiries to be increasing.

There has been a falling off in the demand for road-building equipment. This is normally the beginning of the dull season in this line. This year frequent rains have delayed the work of building contractors, costing them heavily, so that they are in no mood to buy anything they can do without. The demand for electrical equipment still continues uniformly good.

General business conditions are good and it is expected that the last half of the year will be better than the first.

Milwaukee

Manufacturers of metal-working equipment appear to be more concerned about getting production in pace with delivery specifications than about new business. While it is true that fresh orders are not particularly numerous, there is considerable business to be worked through for shipment, and enough pressure is being exerted by buyers to create an active state of affairs.

Inquiry is improving and the trade looks for an active business for at least five or six months. Automobile factories have turned their attention from toolroom equipment to production machinery, and a healthy volume of equipment is being ordered for delivery between now and early spring.

General industrial buying is only fair, but signs are at hand indicating that considerable equipment will be needed in order to meet the demands of improving business. Many machine shops are taking advantage of present plant area to increase output by installing additional tools. There also is a continuation of the retooling for greater plant efficiency and production economy.

Dealers are experiencing a moderate call for light tools from garages and are able to work considerable used equipment into similar channels.

Philadelphia

Reports from the machinery and machine tool trade in Philadelphia in the last fortnight indicate a good fall business. Both large and small dealers and producers report the receipt of inquiries which have come in recently, and which indicate there is a basis in fact for the reports.

Current business continued on a satisfactory level during the past week. There is a slight advance in the volume for the present period as compared with the corresponding months of 1925. The call for prices on portable tools from railroads has featured the situation. Inquiries from other sources have been spotty. The general situation forecasts a realization of earlier predictions that the year's volume of business will be well over that of last year.

Chicago

If inquiries and the business actually transacted in machine tools during the first week in September be accepted as an augury of a good fall trade, machinery men say they have reason to believe that a continuation of the exceptional midsummer activity that prevailed in July and August will be carried into the next two or three months. It is impossible to forecast the trend of the machinery market for any given length of time, but if the consensus of opinion of men who study the country's industrial conditions and prospects be given weight, there will be considerable activity in the machine tool industry, at least until December; beyond that they do not care to hazard a prophecy.

Such business as is being done at this time throughout the Middle-West comes mainly from general industrial plants. Railroads are not buying to any material extent, although new lists promised in the near future may be expected to stimulate activity in such lines as they require for shop equipment. The automotive industry is not making many inquiries for tools, its requirements being chiefly for replacement purposes.

Manufacturers of automobile accessories are speeding up their plants in a way that is reflected in the machinery market. Demand for grinders is reported by manufacturers' agents to be exceptionally good, and local representatives of makers of electrical tools report business to be considerably in excess of this time last year. The machinery market situation in general may be regarded as very encouraging.

Detroit

After a somewhat slow summer, during which there has been little buying as compared with the early months of 1926, sales of machinery and machine tools in Detroit and other industrial centers in southeastern Michigan appear to be definitely on the upgrade. Evidences of a better fall business have been appearing with greater frequency and leading dealers see a favorable outlook for the remainder of the year.

Buying now is widespread, and while the individual orders are small, machinery salesman believe that the market is enlarging steadily. In addition to the General Motors plants, buying has now extended to Packard, Hudson, Paige, Dodge and Studebaker. Production lines are being strengthened in many automobile factories and orders for single machines and small tools have been numerous.

Used tools of all kinds are finding a ready market, also. This is especially true of such standard machines as millers, shapers, grinders and lathes.

Buying has not been confined to the automobile industry, although this remains the largest source of orders for machinery representatives. The other manufacturing establishments of Detroit have been purchasing new equipment also, this being particularly true with foundries and rolling mills.

Cincinnati

A better general business tone and a slightly livelier market in the past week are reported by Cincinnati machine tool manufacturers and selling agents. Many find that there is less daily fluctuation of sales than there has been, and it is stated that orders and inquiries are coming in more evenly.

In the past week manufacturers and the selling agents received the greater portion of their orders from small shops. A few orders from railroads were booked, calling for replacements and single tools. Concerns in the automotive industries bought a little more freely than in the previous week.

A few export orders were booked in the past week, the greater part of these being from foreign oil fields, with some from England and New Zealand, the latter being for railroad use. Foreign inquiries coming in are taken to indicate that the export business is about to improve.

Taking the Cincinnati industry as a whole, the week's business is regarded as both satisfactory and encouraging, the underlying feeling being that the demand will show a healthy increase as the fall advances.

Machine tool plants are working full time and employing forces of the usual size.

Railway Foremen at Chicago Convention Open Way for Tool Standardization

Management, costs and repairs among topics discussed

Broader topics and a pronounced interest in discussions of the papers presented, featured the twentieth annual convention of the International Railway General Foremen's Association, held at the Sherman Hotel, Chicago, Sept. 7, 8, 9 and 10. The attendance increase was 40 per cent over last year. Practically every railroad in this country was represented. An additional feature was the display of mechanical devices, machinery and tools by the Association of Railway Supply Men.

The election of officers for 1926-7 resulted as follows: President, C. A. Barnes, Belt Railway of Chicago; first vice-president, F. M. A'Hearn, Bessemer & Lake Erie R.R.; second vice-president, J. A. Chapman, Illinois Central R.R.; third vice-president, C. F. Bauman, Chicago & Northwestern R.R.; fourth vice-president, J. H. Armstrong, Atchison, Topeka & Santa Fé R.R.; secretary-treasurer, William Hall, Chicago & Northwestern R.R. The executive committee is comprised of the following: H. E. Warner, New York Central R.R., H. Sunderman, Hocking Valley R.R., A. H. Keys, Baltimore & Ohio R.R., F. B. Harmon, Atchison, Topeka & Santa Fé R.R., and A. T. Streeper, Nickel Plate R.R. It was voted to hold the next convention at the same location.

Railroads Are Prosperous

President H. E. Warner in his address said: "We, as general foremen, must take up more varied subjects at our conventions, such as those that pertain to the management of shops, cost of repairs, standardization, routing of work, and developing mechanics and foremen, and leave the detailed work of the various departments, such as air brake, blacksmithing, boilermaking, toolmaking, and pipe fitting, to other organizations to discuss.

"The past few years has brought great prosperity to our railroads and, during this time, progress has been made in every direction. Each member should consider that he has played an important part in this development, and that his company has sent him to this convention to gain knowledge that will better his work, and make his road more efficient and of greater benefit to the public. We are living in an age of rapid changes, and the man who succeeds must be alive and awake to every new and changing condition.

The convention consisted of seven sessions in which the following papers and addresses were presented:

An address, "The Possibilities of the General Foremen's Association," by E. L. Woodward, Western Editor, *Railway Mechanical Engineer*. "Balancing Shop Sub-Department," by F. S. McCarthy, B. & O. R.R. "Development of the Mechanic," by R. J. Farrington, P. & L. E. R.R. "Maintenance of Refrigerator Cars," by J. N. Chapman, I. C. R.R. An address by D. B. Curtis, chief purchasing officer, C. M. & St. P. Ry. "The General Foreman's Responsibility for Material Surplus or Shortage," by F. M. A'Hearn, B. & L. E. R.R. An address by F. H. Becherer, assistant to mechanical superintendent, B. & M. Ry. "Developing Railroad Shop Foremen," by A. R. Leverage, A. T. & S. Fé R.R. An address by M. A. Hall, superintendent machinery, K. C. S. Ry. "Modern Shop Equipment as a Factor in Increased Production," by H. W. Harter, C. R. I. & P. R.R. An address by L. K. Pickert, superintendent motive power, Central of Georgia Ry.

List of Exhibitors

The following were among the concerns exhibiting:

Johns-Manville, Inc., Jones & Lamson Machine Co., Pyle National Co., Dearborn Chemical Co., Standard Stoker Co., Standard Oil Co.

Bradford Corporation, Cleveland Tool Engineering Co., Reliance Machine & Stamping Works, Inc., Independent Pneumatic Tool Co., Hunt-Spiller Manufacturing Corporation, Morris B. Brewster, Inc.

E. C. Atkins & Co., Borden Co., National Boiler Washing Co., Armstrong-Blum Manufacturing Co., National Malleable & Steel Castings Co., Jenkins Bros.

Cleveland Pneumatic Tool Co., McLean-Fogg Lock Nut Co., Detroit Lubricator Co., Ashton Valve Co., J. Faessler Co., Oxweld Railroad Service Co.

Ridge Tool Co., Nathan Manufacturing Co., Alexander Milburn Co., American Locomotive Co., Ohio Injector Co., American Locomotive Co.

Nathan Manufacturing Co., Torchweld Equipment Co., Hubbard Steel Foundry Co., Hanna Stoker Co., Duff Manufacturing Co., Barco Manufacturing Co.

Edna Brass Manufacturing Co., Forster Paint and Manufacturing Co., Ingersoll-Rand Co., Oakadee Co., Hauck Manufacturing Co., Air Reduction Sales Co.

Locomotive Stoker Co., Sun Beam Electric Manufacturing Co., Graham-White Sander Corporation., Transportation Devices Corporation, Locomotive Fire Box Co., Crucible Steel Co. of America.

Metal and Thermit Corporation, O'Malley-Beare Valve Co., Pilliod Co., American Brake Shoe & Foundry Co., *Railway Age*, *Railway Mechanical Engineer*.

Transportation Devices Corporation, Pilot Packing Co., Graham-White Sander Corporation, Sunbeam Electric Manufacturing Co., Westinghouse Air Brake Co., Hauck Manufacturing Co.

Viloco Railway Equipment Co., Buffalo Brake Beam Co., Barco Mfg. Co., Hulson Grate Co., Inc., Grip Nut Co., Davis Boring Tool Co.

W. H. Miner, Inc., Cleveland Twist Drill Co., Madison-Kipp Corporation, Chicago Pneumatic Tool Co., Firth-Stirling Steel Co., Goddard & Goddard Co., Huron Manufacturing Co.

Lehon Co., Gairing Tool Co., Union Manufacturing Co., Manning, Maxwell & Moore, Inc., Buckeye Portable Tool Co., Pratt & Whitney Co., Niles-Bement Pond Co.

American Arch Co., Franklin Railway Supply Co., Super-Heater Co., American Throttle Co., *Railway Purchases and Stores*, *Railway Review*, A. O. Norton Inc.

Snap-On Wrench Co., Colonial Steel Co., Midwest Valve Corporation, Clark Manufacturing Co., and Smith Welding Device Corporation.

The entertainment consisted of a mardi gras and informal dance on the first night; a banquet and vaudeville entertainment on the second night, and an informal dancing party on the third night. Special entertainment, such as a card and a theater party, was provided for the ladies. Brief abstracts of some of the papers presented will be published in the next issue.

Franco-German Accord Reduces Dues on Tools Entering France

By Our Paris Correspondent

The Franco - German commercial treaty signed recently grants the latter country special import facilities for a long list of products entering the Saar department, now under the control of France. The list so far as affecting tools and machinery is as follows: Certain items are based only upon contingent quantities whereas others are not limited as to quantity.

	Reduction from General Import Tariff Per Cent
Revolution counters	Minimum tariff
Steam, oil and other prime movers, explosion, Diesel, etc.	66
Road building machinery	Minimum tariff
Plunger pumps	83
Knitting machinery	Minimum tariff
Paper-making machinery	Minimum tariff
Printing machinery	50
Certain agricultural machinery	Minimum tariff
Other agricultural machinery	80
Hoisting machinery	50
Pressing machinery	66
Tools in iron or steel, with handles or not	90
Iron castings, nickeled, coppered or enamelled	80
Construction or building hardware, each piece weighing at least 5 kilos	90
Screws in iron or steel, with certain exceptions (in rough)	75
Screws, turned or polished	60
Apparatus for chemical manufacture	80
Clocks, alarm clocks, etc.	65 to 80
Air or water cooled cylinders for explosion motors	85
Stoves and ranges	80
Ball bearings	66
Machine tools	55 to 80
Electric soldering machinery and tools	33
Sewing machines	Minimum tariff
Electric boring or piercing machines	33
Zinc, nickel and aluminum objects	60 to 80
Automobile horns	90
Railway carriages	75
Street railway carriages	75
Surveying instruments of metal	50
Measuring instruments, including drawing instruments and gages	50
Photographic apparatus	40

The accord went into effect on Aug. 20 and is intended to benefit the district of the Saar in that it may thus be supplied with necessary materials and elements which, since the French control, have been wanting at appropriate prices in that important economic district now under French influence. The accord is to endure for six months and may be renewed upon mutual agreement between France and Germany at that time.

Business Items

The Bilodeau Ball Bearing Works, of Boston, has moved to 92 Brookline Ave.

The Mechanics Tool and Supply Co., of Indianapolis, has opened offices at 15 Kentucky Ave. in that city.

The Beaver Machine and Tool Co., of Syracuse, N. Y., has changed its name to the Beaver Machine and Die Co.

The Societe Anoyme Alfred Herbert announces the removal of its Paris offices from 47 Boulevard de Magenta to 1 and 3 Rue de Delta.

The Fulton Saw Works, of Chicago, heretofore owned and operated by Sears, Roebuck & Co., has been bought by the Danly Machine Specialties Co. The new owners will erect a foundry and other buildings in connection with the plant.

The Economy Pumping Machinery Co., of Chicago, has leased from the trustees of the Central Manufacturing District 37,600 sq.ft. of ground on W. Forty-eighth Place, east of St. Louis avenue, where it will erect a building.

The U. T. Hungerford Brass and Copper Co., of New York, announces the removal of its Philadelphia warehouse to 46 N. Sixth St., corner of Filbert St. The new quarters provide greater facilities for storage of materials and quicker service.

Articles of incorporation have been filed at Indianapolis by the Johns Equipment Co., of Fort Wayne, Ind. The company will deal in construction and industrial machinery and supplies. The incorporators are E. W. Johns, Herschel Platt and J. C. Warner.

The Campbell Wire Specialty Works has been purchased by Woodward G. Jeschke, who for the past five years had been manager of the company. The plant will be moved to Crawfordsville, Ind., and the same business policy and principles of manufacture will be carried on under the new management.

The railroad department of the Chicago Pneumatic Tool Co. has opened offices in the Straus Bldg., and will hereafter function apart from the industrial department. On Oct. 1, the premises occupied by this company at 572 W. Randolph St. will be vacated, and the business removed to its own building at 3655 Iron St.

The plant of the Canadian Western Steel Corporation at Medicine Hat, Alberta, which has been idle for some years, has been purchased by the United States Horseshoe Manufacturing Co. of Erie, Pa. The latter is also negotiating for the purchase of Redcliffe Rolling Mills, the equipment of which would be moved to Medicine Hat to enlarge the local plant for iron-rolling process.

E. C. Townshend, Boston, Mass., has purchased $400,000 of receivers certificates of the Vermont Farm Machine Corporation, of Bellows Falls, Vt., and has petitioned the United States Court for authority to buy the entire plant, equipment, patents and good will of the company at a sale to be held Oct. 16. The company has been in the hands of a receiver for six years. Mr. Townshend is anxious to gain control and rehabilitate the property.

The Kuhlman Electric Co., of Bay City, Mich., manufacturers of power, distribution and street lighting transformers, announces the opening of a direct factory branch office in Atlanta, Ga. The office is located at 411 Glenn Bldg. and is in charge of Ernest K. Higginbottom. During the past two years, Mr. Higginbottom has represented the Kuhlman Electric Co. throughout the Southeast. Previous to that time his headquarters were at the main office and factory.

The Bertram Machine plant in Dundas, Canada, which for several years past has been operated as a Canadian branch of the Niles-Bement-Pond Co., has been restored to Canadian ownership with the Bertram interests in control, it is reported. The latter have acquired the plant, and also the plant of the Pratt & Whitney Co., also in Dundas. It is understood that the new company will bear the name of Bertram. New officers of the company are: President and general manager, Henry Bertram; vice-president, James Young; secretary-treasurer, H. Graham Bertram; chief engineer, A. W. Parks; sales manager, G. H. Howard; directors, James K. Cullen, Charles L. Seymour, G. M. Levy, A. F. Pirie and James B. Bertram.

Personals

CHARLES P. COLEMAN, retired president of the Worthington Pump and Machinery Corporation, has been elected a director of that firm.

CARL A. STEVENS has resigned from the Studebaker Corporation and has become research and plant engineer for the Oakland Motor Car Co., of Pontiac, Mich.

JOHN A. EMBRY, of Dade City, Fla., has been appointed trade commissioner in Vienna, Austria, for the Department of Commerce.

L. H. DIETZ, formerly associated with the Walworth Co., has joined Grant Campbell as consulting engineer at Short Hills, N. J.

E. R. ZADEMACH has been appointed vice-president and general manager of the Metalwash Machine Co., of New Rochelle, N. Y.

PAUL J. NUTTING is now associated with the H. S. Lee Foundry and Machine Co., of Plymouth, Mich. He was formerly with the Binney Casting Co., of Toledo.

COL. W. A. GASTON, prominent industrialist, has been elected a director of Dodge Brothers, automobile manufacturers, of Detroit.

W. H. SCHULTE has become general superintendent of the S. Cheney & Son Co., of Manlius, N. Y. He was formerly with the American Foundry Equipment Co.

VERGIL A. DAVIDSON, who has been production manager for General Motors Continental, at Antwerp, Belgium, is now located at the New York office of the General Motors Export Co.

SAMUEL A. GASKELL has retired from the management of the Lancashire Dynamo and Motor Co. of Canada and will be succeeded by G. Garfield Abbey, who will act as managing director of the company.

CHARLES P. MCCARTHY has been appointed superintendent of the new plant of Durant Motors, Inc., at Elizabeth, N. J. This plant will be used for the manufacture of Flint cars and for the assembly of Star 1-ton trucks.

ERASTUS PHIPPS, superintendent of the Duesenberg Motors Co., of Indianapolis, was seriously injured and his daughter was killed on Aug. 29 when an automobile in which they were riding near Detroit, struck the rear end of a truck.

C. H. JOHNSON has been appointed engineer in charge of the service department of the Timken Roller Bearing Co., Canton, Ohio. He will have direct charge of the installation of Timken bearings in industrial and automotive applications.

MERRIL C. MORROW has been appointed assistant sales manager of the merchandising department of the Westinghouse Electric and Manufacturing Co. Mr. Morrow has been assistant to the general manager of this department for some time.

M. H. PETTIT has been appointed vice-president and assistant general manager of the Nash Motors Co. Mr. Pettit had recently been associated with the Simmons Co., of Kenosha, Wis., and with the J. I. Case Threshing Machine Co.

JOHN MCGEORGE, consulting engineer, has been appointed to take charge of the oven and conveying business of the McCann-Harrison Corporation. He will be located at 5005 Euclid Ave. Mr. McGeorge was formerly associated with the Oakland Motor Car Co. and with the J. B. Webb Co.

JOHN CETRULE, manager of the Triplex Machine Tool Co., of 50 Church St., New York, returned last week from Europe. Mr. Cetrule spent two months visiting various machine building plants in Switzerland, Germany, France and Italy with the view to enlarging the market possibilities of machines for which his company is the agent in this country.

J. J. SHEEHAN, toolroom supervisor for the Norfolk & Western R.R., Roanoke, Va., will retire from active service Sept. 30, after forty-three years of service in this company. In view of his retirement and as a reward of his activities, Mr. Sheehan was made an honorary life member of the American Railway Tool Foremen's Association at its convention, held in Chicago early this month.

Obituaries

ALFRED ERNEST TERRY, director of H. Terry & Sons, Ltd., Redditch, England, spring makers, etc., died recently. He was 53 years old.

CHRISTOPHER WILLIAM JAMES, chairman of directors of J. Buckton & Co., Ltd., Leeds, England, makers of heavy machine tools and large testing machines, died on Aug. 13. He was 61 years old.

S. H. SQUIER, who retired several years ago as vice-president of the Milwaukee Electric Crane and Manufacturing Co., died at his home in Wauwatosa, Wis., on September first.

CARLYLE JOHSON, founder of the Carlyle Johnson Machine Co., Manchester, Conn., died at his home in Hartford on Sept. 12. Mr. Johnson began his career with the Pratt & Whitney Co., but formed his own firm to promote his inventions of friction clutches and other mechanical devices.

Forthcoming Meetings

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

American Institute of Mining and Metallurgical Engineers. General meeting, Hotel Schenley, Pittsburgh, Oct. 5 to 9. H. F. Bain, secretary, 29 West 39th St., New York City.

American Management Association. Fall meeting, Hotel Statler, Cleveland, Oct. 11 and 12. W. J. Donald, managing director, 20 Vesey St., New York City.

American Gear Manufacturers Association. Semi-annual meeting, Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 14, 15 and 16. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Iron and Steel Institute. Fall meeting, Hotel Commodore New York, Oct. 22. E. A. S. Clarke, secretary, 40 Rector St., New York City.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

The principal price change noted in this section is the revision of the sheet schedule which has been generally accepted by manufacturers. Not only are base prices changed, but in the case of black and galvanized sheets the differentials also have been changed. Full details will be given in this section next week. Pittsburgh reports an unusually active iron and steel market. Chicago reports satisfactory business, with 25 out of its 36 blast furnaces in operation. Inquiries for large rail tonnages are expected shortly. Sales thus far in 1926 are well over the volume of those in the same period of 1925.

(All prices as of Sept. 10)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	19.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York
No. 10	2.30	3.89
No. 12	2.35	3.94
No. 14	2.40	3.99
No. 16	2.50	4.09
Black		
Nos. 18 to 20	2.80	4.15
No. 24	3.00	4.35
No. 26	3.10	4.45
No. 28	3.25	4.60
Galvanized		
No. 10	3.15	4.40 to 4.55
Nos. 12 to 14	3.25	4.50 to 4.65
No. 16	3.35	4.60 to 4.75
No. 18	3.50	4.85 to 4.90
No. 20	3.65	4.90 to 5.05
No. 24	3.85	5.10 to 5.25
No. 26	4.10	5.35 to 5.50
No. 28	4.60	5.60 to 5.75

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — B.W.G. and Decimal	Fractions	Outside Diameter in Inches — ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8.35c.; ¼, 7.85c.; ⅛ to ½, 7.35c. per lb. *Flat, ⅛@½-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.62½
Tin, 5-ton lots, New York			67.50
Lead (up to carlots) E. St. Louis	8.65	New York	9.50
Zinc (up to carlots) E. St. Louis	7.40	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot.	18.00	20.50	17.00
Copper sheets, base	23.00	23.00	23.00
Copper wire, base	20.00	20.00	16.50
Copper bars, base	22.62½	22.62½	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, base	19.37½	19.37½	19.37½
Brass tubing, base	24.25	24.25	23.75
Brass rods, base	17.12½	17.12½	17.12½
Brass wire, base	19.87½	19.62½	19.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	12.55	12.01
Solder (½ and ½), (case lots)	41.12½	42.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	82.50
Commercial genuine, intermediate grade	56.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	14.75

Nickel, f.o.b. refinery, cents per lb.:

Ingots..... 35 00 Electrolytic.. 39.00 Shot.....36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.37½@12.62½	11.50	11.25@11.75
Copper, heavy, and wire	11.62½@12.12½	11.75	10.75@11.25
Copper, light, and bottoms	10.00 @10.37½	10.00	9.50@10.25
Heavy lead	7.50 @ 7.75	7.00	7.00@ 7.50
Tea lead	5.50 @ 6.00	5.00	6.00@ 6.50
Brass, heavy, yellow	7.25 @ 7.50	7.50	7.25@ 7.75
Brass, heavy, red	9.50 @10.00	9.75	9.00@ 9.50
Brass, light	6.00 @ 6.25	6.00	6.75@ 7.25
No. 1 yellow rod turnings	8.25 @ 8.50	8.00	7.75@ 8.25
Zinc	4.25 @ 4.75	4.50	4.25@ 4.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade: IC,	14x20	$12.10	$11.95	$11.50
"A" Grade: IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box 100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	2.70†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.95½	1.05	.92
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.1712½	.1687½	.1687½
Solder (½ and ½)	per lb.	.4112½	41	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7 00	7 00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3 10	3.55	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.49
Cloth	3.10	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@ 3.50
Coke, prompt foundry, Connellsville	per net ton		4.25@ 5.00
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16 75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{7}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{7}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ½-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ind., Hammond—H. Budd, 266 Fayette St.—brake, square shears.

Mass., South Boston (Br. Boston)—R. H. More, 630-66 East 2nd St.—miscellaneous tools and equipment for large repair and service garage on East 2nd St.

Mass., South Boston (Br. Boston)—Old Colony Realty Co., 384 Dorchester Ave.—equipment for garage and light manufacturing plant at Old Colony Ave. and D St. Estimated cost $175,000.

Mich., Detroit—P. Dubrovsky, 3810 Gilbert West — lathe, milling machine, drill press, emery wheel, electric motor and transmission

N. Y., Brooklyn—A.A.A. Art Metal Co., 2461 East 16th St., J. Barsky, Purch. Agt.—three 8 ft. squaring shears.

N. Y., New York—Plugfit Piston Co., 318 West 48th St.—Heald cylinder grinder, 1 filing machine and 2 drill presses.

N. Y., New York—Sturtevant Tool Co., 1023 East 176th St.—one 20 to 24 in. lathe.

O., Youngstown — Owner Co. — surface grinder, Universal or other standard make.

Wis., Milwaukee—White Co., 842 East 79th St., Cleveland, O.—machine tools for repairing auto trucks for proposed service station and garage on Clyborn St., here.

Wis., West Allis—Bd. Industrial Education, D. S. Moore, Pres.—machine shop equipment, etc. for proposed 3 story 68 x 103 ft. vocational school, on Colburn Ave.

Australia, Melbourne—Victorian Government Railways, will receive bids until November 3rd, for duplex boring machine and turning mill, also milling machines with equipment.

Opportunities for Future Business

Ala., Birmingham—City plans the construction of garage. Estimated cost $250,000.

Ala., Birmingham—McWane Cast Iron Pipe Co., 3600 11th Ave., N. will soon award contract for the construction of 2 story 50 x 150 ft. service building, at 11th Ave. and 36th St., here. Estimated cost $40,000. Knight & Davis, 1603 Empire Bldg., Archt. Noted May 6.

Calif., Los Angeles—Los Angeles Casing Co., 3033 East Vernon Ave. awarded contract for the construction of 1 and 2 story, 120 x 145 ft. factory, at 3600 East 25th St., here. Estimated cost $40,000.

Conn., New Haven—G. Ratner, 42 Church St. will build 2 story, 50x480 ft. garage on Chapel St. Estimated cost $150,000.

Conn., South Norwalk—D. J. Mellilo, 91 North Main St., is having plans prepared for the construction of 2 story, 15 x 50 ft. and 40 x 160 ft. garage and repair shop on North Main St. Estimated cost $75,000. A. S. Meloy, 2965 Main St., Stratford, Archt.

Conn., Winsted—Strand & Sweet Mfg. Co., Meadow St. awarded contract for 2 story, 50 x 80 ft. wire factory, here. Estimated cost $40,000. Noted Aug. 12.

Fla., Jacksonville—Moore Pipe & Sprinkler Co., P. O. Box 1117, plans the construction of plant for the manufacture of sprinkler systems, at State and Blanche Sts. Estimated cost $75,000.

Ill., Chicago—Chicago Solder Co., 4401 Wrightwood Ave. awarded contract for the construction of 1 story addition to factory, at 104 South Michigan Ave. Estimated cost $50,000.

Ill., Chicago—International Steel & Iron Co., 3936 South Lincoln St. awarded contract for the construction of 1 story, 175 x 325 ft. plant. Estimated cost $200,000.

Ind., Fort Wayne—Fort Wayne Tank & Pump Co., plans the construction of 2 story, 60 x 85 ft. addition. Estimated cost $45,000. C. R. Weatherhogg, 250 West Wayne St., Archt.

Ind., Gray—Parry & Shaw is having plans prepared for the construction of 3 story garage on Washington St., near 8th St. Estimated cost $200,000. H. Warriner, Gary Archt.

Ky., Newport—Higgin Manufacturing Co., plans the construction of 3 story, 31 x 38 ft. addition to hardware manufacturing plant. L. H. Wilson, 10 West 4th St., Archt.

Mass., Roxbury (br. Boston)—H. M. Rittenberg, 12 Garden St., Boston awarded contract for the construction of 1 story, 55 x 200 ft. and 30 x 40 ft. garage and repair shop at 2038-44 Washington St., here. Estimated cost $60,000.

Mass., Somerville—Boston Elevated R.R. Co., 31 St. James Ave., Boston will build 1 story rail bending shop, on George St. Estimated cost $40,000.

Mass., Springfield—A. O. Standish, 176 Main St., is having plans prepared for the construction of 1 story, garage and repair shop at 135 Main St. Estimated cost $40,000. H. J. Tessier, 534 Main St. Archt.

Mass., Watertown—Stuart Marshall Realty Co., 286 Centre St., Newton, awarded contract for the construction of 1 story, repair garage here. Estimated cost $40,000. Noted Sept. 2.

Mich., Detroit—Lincoln Forging Co., 622 St. Antine St. plans the construction of 2 story, 60 x 100 ft. addition to plant, here. Estimated cost $80,000. J. G. Foyer, Secy.

Mich., Hillside — Richard Brothers Die Works, Inc., 1560 East Milwaukee Ave., Detroit, awarded contract for the construction of 1 story, 35 x 90 ft. plant, here. Estimated cost $65,000.

Mich., Menominee—Bates Valve Bag Co., 8240 South Michigan Ave., Chicago, plans the construction of a 1 story, 80 x 240 ft. branch factory, here. Estimated cost, including equipment $80,000.

Minn., Minneapolis — Minneapolis Heat Regulator Co., 2753 4th Ave. S., B. L. Boalt, Secy. awarded contract for the construction of 5 or 6 story, 80 x 150 ft. addition to manufacturing plant, at 2753 4th Ave. S. Estimated cost $200,000.

N. J., Paterson—Sipp Machine Co., Keene St. awarded contract for the construction of 1 story, 40 x 60 ft. addition to plant for manufacture of textile machinery, here. Estimated cost $20,000.

N. Y., Long Island City—C. Proescher, Inc., 84 8th St., awarded contract for the construction of 2 story, 50 x 120 ft. addition, to sheet metal works here. Estimated cost $50,000.

O., Ashland—Department Highways and Public Works, Ohio - Hartman Bldg., Columbus, will soon award contract for the construction of 1 story, 80 x 120 ft. garage. Estimated cost $22,000. H. B. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

O., Cincinnati—Chevrolet Motor Co., Norwood, awarded contract for the construction of plant addition, here. Estimated cost $230,000.

O., Cincinnati—Record Garage Co., 3rd Ave. and Vine St. is having plans prepared for the construction of 6 story, 92 x 165 ft. repair and service garage Estimated cost $335,000. Hannaford & Son, Dixie Terminal Bldg., Archts.

O., Dayton—Constructing Quartermaster, Wright Field, will receive bids until October 7, for the construction of an assembly shop building, at Wright Field, here.

O., Marietta — Safe Cabinet Co., subsidiary of Kardex Bureau, Inc., North Tonawanda, N. Y. awarded contract for the construction of 4 story, 50 x 188 ft. addition to plant, here. Estimated cost $165,000.

Okla., Oklahoma City—Huges Tool Co., 12-20 West 20th St., awarded contract for the construction of story, 40 x 100 ft. shop, for welding works.

Okla., Oklahoma City—A. J. Reinhart, et. al., Tradesmens National Bank Bldg., is having preliminary plans prepared for the construction of 7 story automobile service and repair garage. Estimated cost $150,000.

Pa., Altoona — Altoona School District plans the construction of annex with vocational shops, etc. at Senior High School, here. Estimated cost $500,000. Architect not selected.

Pa., Altoona — M. Smith, Purch. Agt. Pennsylvania R.R. Co., Broad Street Station, Philadelphia awarded contract for the construction of 1 story, 120 x 600 ft. tank shop here. Estimated cost $250,000. Noted Aug. 19.

Pa., Chester—American Locomotive Co., awarded contract for the construction of 1 story, 85 x 70 ft. repair shop, at Delaware and Jeffery St.

Pa., McKees Rocks—Pressed Steel Car Co., Farmers Bank Bldg., Pittsburgh, is having plans prepared for the construction of 1 story forge shop, here.

Pa., Philadelphia—Edward G. Budd Co., 25th St. and Hunting Park Ave. awarded contract for the construction of 5 story addition to plant, here Estimated cost $1,000,000. Noted Aug. 26.

Pa., Philadelphia — Leeds & Northrop, awarded contract for the construction of 4 story addition to plant for manufacture of electric measuring instruments at 4901 Stenton Ave.

Pa., Philadelphia — Philadelphia Gear Works, Richmond and Tioga Sts. will soon receive bids for the construction of 2 story addition to plant. Estimated cost with equipment, $150,000. H. W. Castor, Stephen Girard Bldg., Archt.

Pa., Philadelphia — Wiedemann Machine Co., 1815 Sedgley St. awarded contract for the construction of 1 story addition, here.

Pa., York—Read Machinery Co., awarded contract for the construction of 1 story, 80 x 192 ft. manufacturing plant. Estimated cost $50,000.

W. Va., Williamson—Norfolk & Western Railway, Roanoke, awarded contract for the construction of 1 story, round house and machine shop, here. Estimated cost $115,000.

Wis., Cedarburg — American Electric Motors Inc., 57 Erie St., Milwaukee, awarded contract for structural steel, for 1 story, 142 x 166 ft. factory, here. Noted Aug. 5.

Wis., Kenosha—Nash Motors Co., Edward St. awarded contract for the construction of 1 story, 100 x 600 ft. addition to plant. Estimated cost $100,000. Noted Sept. 9.